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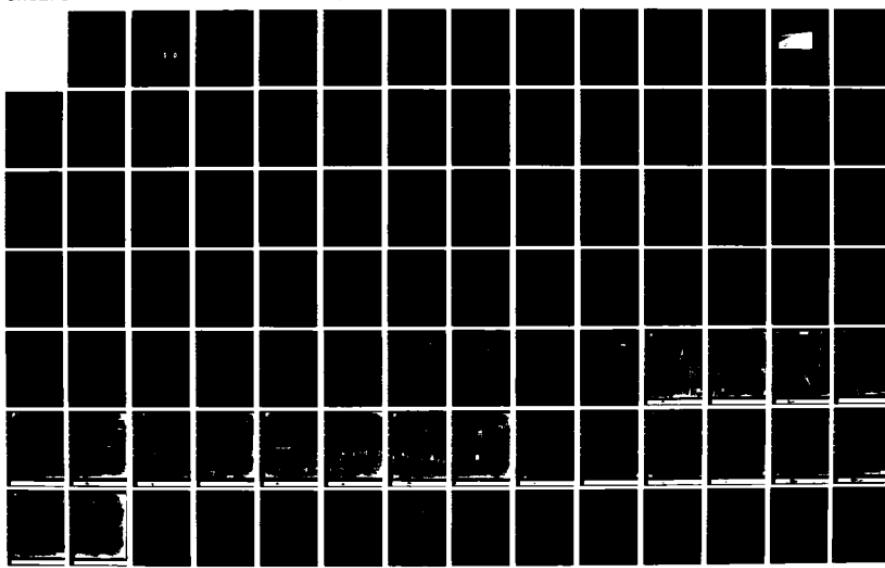
NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS  
CLEVELAND BROOK RESER. (U) CORPS OF ENGINEERS WALTHAM  
MA NEW ENGLAND DIV JUN 79

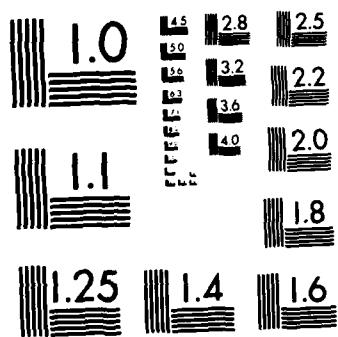
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HOUSATONIC RIVER BASIN  
HINSDALE, MASSACHUSETTS

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CLEVELAND BROOK RESERVOIR DAM  
MA 00225

PHASE I INSPECTION REPORT  
NATIONAL DAM INSPECTION PROGRAM

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JUN 3 1985  
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DEPARTMENT OF THE ARMY  
NEW ENGLAND DIVISION, CORPS OF ENGINEERS  
WALTHAM, MASS. 02154

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER MA 00225	2. GOVT ACCESSION NO. <i>A154494</i>	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Cleveland Brook Reservoir Dam  NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS		5. TYPE OF REPORT & PERIOD COVERED INSPECTION REPORT
7. AUTHOR(s) U.S. ARMY CORPS OF ENGINEERS NEW ENGLAND DIVISION		6. PERFORMING ORG. REPORT NUMBER
9. PERFORMING ORGANIZATION NAME AND ADDRESS		8. CONTRACT OR GRANT NUMBER(s)
		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS DEPT. OF THE ARMY, CORPS OF ENGINEERS NEW ENGLAND DIVISION, NEDED 424 TRAPELO ROAD, WALTHAM, MA. 02254		12. REPORT DATE June 1979
		13. NUMBER OF PAGES 120
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18. SUPPLEMENTARY NOTES Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) DAMS, INSPECTION, DAM SAFETY,		
Housatonic River Basin Hinsdale, Massachusetts		Cleveland Brook
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The facility at Cleveland Brook Reservoir includes a 1,650 foot long earth dam approximately 71 feet high and 1140 feet of earth dikes, including a 80 foot long concrete spillway. The dam is considered to be in fair condition. It is classified as being intermediate in size and high in potential hazard. Investigations are recommended to determine the significance of the seepage.		



DEPARTMENT OF THE ARMY  
NEW ENGLAND DIVISION, CORPS OF ENGINEERS  
174 FAIRFIELD STREET  
WALTHAM, MASSACHUSETTS 02454

RECORDED  
OCT 11 1979  
NEEDS

OCT 11 1979

Honorable Edward J. King  
Governor of the Commonwealth of  
Massachusetts  
State House  
Boston, Massachusetts 02133

Dear Governor King:

Enclosed is a copy of the Cleveland Brook Reservoir Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Department of Environmental Quality Engineering, the cooperating agency for the Commonwealth of Massachusetts. In addition, a copy of the report has also been furnished the owner, City of Pittsfield, City Hall, Pittsfield, Massachusetts 01202.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Department of Environmental Quality Engineering for your cooperation in carrying out this program.

Sincerely,

MAX B. SCHEIDER  
Colonel, Corps of Engineers  
Division Engineer

in: 1  
As sent

CLEVELAND BROOK RESERVOIR  
MA 00225

HOUSATONIC RIVER BASIN  
HINSDALE, MASSACHUSETTS

PHASE I INSPECTION REPORT  
NATIONAL DAM INSPECTION PROGRAM

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**PHASE I INSPECTION REPORT**  
**NATIONAL DAM INSPECTION PROGRAM**

Identification No. : MA 00225  
Name of Dam: CLEVELAND BROOK RESERVOIR DAM  
Town: HINSDALE  
County and State: BERKSHIRE, MA  
Stream: CLEVELAND BROOK  
Date of Inspection: 1 MAY 1979

**BRIEF ASSESSMENT**

The facility at Cleveland Brook Reservoir includes a 1,650 foot long earth dam approximately 71 feet high and 1140 feet of earth dikes, including a 80 foot long concrete spillway. Dike A is approximately 17 feet high and is perpendicular to the dam's right abutment. The earth embankments on each side of the concrete spillway, which are located approximately 1700 feet southeast of Dike A, are known as Dike B and Dike C. A portion of the crest of Dike B is depressed for 135 feet in length to form an overflow spillway. The crest elevation of the remaining portion of Dike B and all of Dike C is 1 foot lower than both the main dam and Dike A. Intakes are present at the gatehouse on the main dam for water supply to the City of Pittsfield. A reservoir drain is present beneath the main dam, but this structure has not been maintained. A blowoff pipe from the 30-in. water transmission main presently serves as a reservoir drain. The facility was originally constructed in 1949 to provide water to the City of Pittsfield. The dam was raised in height a total of 5 feet in 1963.

The dam is considered in fair condition due to observed seepage at the main dam, as well as at Dikes B and C. A 1977 report by the firm of Metcalf and Eddy is available on the seepage observed at the right abutment of the main dam. No prior investigations are known of the seepage at other locations.

Based on the size classification, intermediate, and hazard classification, high, in accordance with Corps of Engineers Guidelines, the spillway test flood is the Probable Maximum Flood (PMF). Hydraulic analysis indicates that the spillways can pass the routed test flood outflow of 2,200 cfs with approximately 0.65 feet of freeboard remaining with respect to Dikes B and C. The combined discharge capacity of both the main and overflow spillways was estimated to be 6,480 cfs with the water surface at the top of dam.

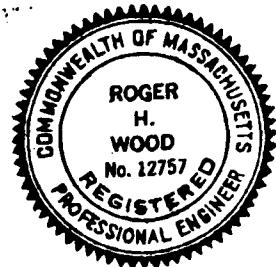
Investigations are recommended to determine the significance of the seepage observed along the toe of the main dam and downstream from Dikes B and C and to continue the monitoring of the piezometers and implement remedial measures for control of the seepage at the right abutment of the main dam. Remedial measures recommended for this facility include the continued mowing of slopes, the filling of animal burrows, the repair of the

protective casing at piezometer B-4, the removal of weed growth from spillway concrete joints, removal of debris from spillway apron, repair of deteriorated concrete at the reservoir drain, the clearing of debris from the invert of the reservoir drain, the cleaning and painting of the reservoir drain flap valve, the placing of stones at the end of the access bridge to the gatehouse, the removal of soil and vegetation from the top of the blowoff structure and the cleaning of the blowoff structure outlet channel. The Owner should develop a formal maintenance program, operational procedure, emergency preparedness plan, and institute a program of annual technical inspections. The remedial measures and recommendations should be performed within one year of receipt of this report by the Owner.

CAMP DRESSER & McKEE INC.

*Roger H. Wood*

Roger H. Wood  
Vice President



This Phase I Inspection Report on Cleveland Brook Reservoir Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

*Joseph W. Finegan*  
JOSEPH W. FINEGAN, JR., MEMBER  
Water Control Branch  
Engineering Division

*Joseph A. McElroy*  
JOSEPH A. MCELROY, MEMBER  
Foundation & Materials Branch  
Engineering Division

*Carney M. Terzian*  
CARNEY M. TERZIAN, CHAIRMAN  
Chief, Structural Section  
Design Branch  
Engineering Division

APPROVAL RECOMMENDED:

*Joe B. Fryar*  
JOE B. FRYAR  
Chief, Engineering Division

## PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I Investigations are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the test flood is based on the estimated "probable maximum flood" for the region (greatest reasonably possible storm runoff), or a fraction thereof. Because the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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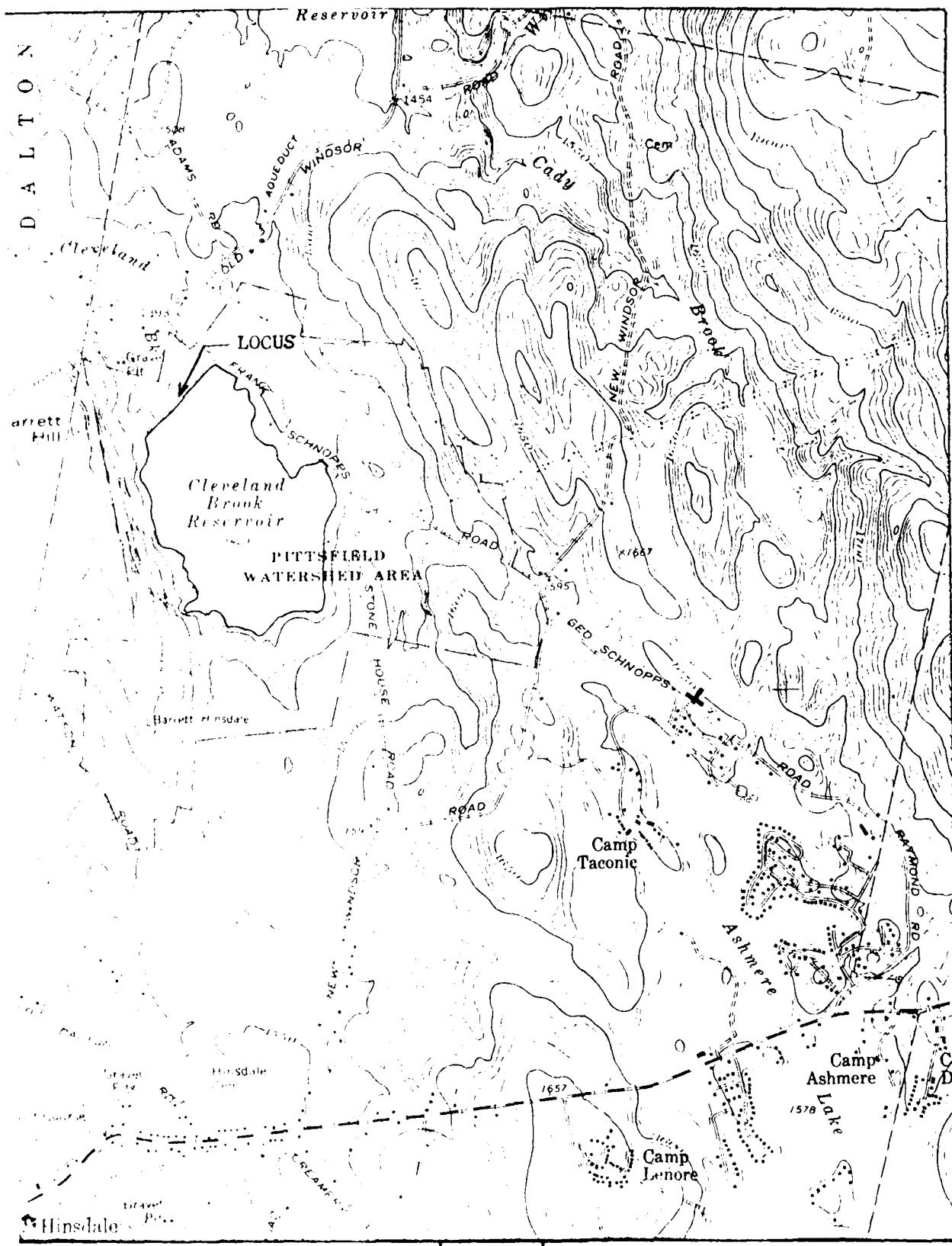
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1. OVERVIEW OF DAM FROM RIGHT ABUTMENT.



## THE CLEVELAND BROOK RESERVOIR

IDENTIFICATION NO. MA 00225



LOCATION MAP  
USGS QUADRANGLE

PERU, MASS

APPROX. SCALE: 1" = 2000'

The gatehouse, spillway, reservoir drain structure and blowoff structure are in generally good condition. Minor items requiring attention were present at most of these structures. Seepage was noted around the concrete walls of the spillway and reservoir drain outlet structure. However, the flow at these locations appear to be seepage associated with the dikes and main dam rather than with the structures themselves.

- d. Reservoir Area - The reservoir is surrounded by moderately sloping, heavily forested hills. There is no development within the watershed of the reservoir. There was no observed potential for major slope failure into the reservoir which could result in waves that might overtop the dam or dikes. No conditions were noted which could cause a sudden increase in sediment load into the reservoir. There have been no apparent alterations to the surface of the watershed which could extensively effect the runoff characteristics as they existed during the design of the facility.
- e. Downstream Channel - The channel immediately downstream of the spillway is a flat, grassed waterway flowing to a drop inlet about 50 feet from the spillway. The spillway outflow enters the drop inlet and is carried under Frank Schnopps Brook via two 18-in. culverts. The culvert capacity is normally exceeded during the spring runoff season and the road is frequently overtopped. Beyond Frank Schnopps Road the downstream channel proceeds through an undeveloped swampy area to a culvert under Old Windsor Road before joining Cleveland Brook which originates at the downstream toe of the reservoir's main dam. The main dam is about 2,000 ft upstream of the confluence of Cleveland Brook and Schnopps Brook. Cleveland Brook follows a steep grade through a slightly developed area to a flat area better known as the Wachonah Country Club where it joins the East Branch of the Housatonic River. The Wachonah Regional High School is located in this flat area on the left bank of the river. The channel proceeds to Center Pond, through the middle of the Town of Dalton, and then through a series of mill dams to a gravel pit and railroad yard area on the east side of the City of Pittsfield. It then flows through the City of Pittsfield before joining with the West Branch of the Housatonic River to become the Housatonic River. The Housatonic River meanders through the southeastern portions of Pittsfield before entering the Town of Lenox. There is moderate to high density development along the river banks through the Town of Dalton and the City of Pittsfield.

### 3.2 Evaluation

The present performance of the main dam and dike embankments appears to be generally satisfactory. However, because of seepage conditions observed at the Main Dam and at Dikes B and C, the overall condition of the project can be considered only fair. No conditions requiring urgent remedial action were observed.

The observed seepage conditions at the Main Dam and at Dikes B and C are not considered serious at this time. However, changes in the quality or pattern of seepage could indicate the development of problems within the embankments.

2. The crest of each dike has a mowed grass cover as shown in Photo No. 19. The crest elevation appears to be up to about 0.5 ft. below the top of the spillway training walls.
3. The downstream slope of the non-overflow portion of Dike B is grass and weed covered. No evidence of sloughing or other instability was noted. The area below the overflow section is broad, flat and mostly grass covered. There are some bare spots and slight rutting on the downstream slope.
4. The downstream face of Dike C has a mowed grass cover. No evidence of sloughing or other instability was observed.
5. Seepage was noted at the toe of Dike B, at the contact with the left spillway training wall as shown in Photo No. 17. Slight flow was evident but no evidence of soil particle movement was discernible. The area below the spillway was wet and soft.
6. Seepage was observed along both sides of the road below Dike C. Slight flow was noted but no evidence of soil particle movement was observed. A portion of this seepage may originate within the right abutment area.

The main spillway shown in Photos 16 and 18 is in very good condition. Some minor weed growth was observed in the concrete joints, minor debris is present on the spillway apron and minor cracking was noted at some of the construction joints. The downstream channel appears to be overgrown with many young trees as shown in Photo 19. However, the growth does not appear to be a significant obstruction to flow at this time.

The intake gatehouse (control tower) as shown in Photos 8 and 9 appears to be in very good condition. The only deficiency noted was that the approach to the service bridge at the dam end is low as shown in Photo 8.

The reservoir drain outlet structure shown in Photo 5 is in fair condition. The base slab contains debris, which may prevent the flap valve from operating. The top of the right concrete wall has started to deteriorate. Moss growth is present at the top of the concrete head wall. The flap valve is rusted. A flow of water was noted to be exiting from behind both side walls. The downstream channel is overgrown with marsh grass and some young trees.

The chamber containing the manually operated blowoff valve downstream of the dam, as shown in Photo 10, was not accessible for inspection. The top slab is covered with leaves, soil and minor vegetation. The outlet pipe from the blowoff shown in Photo 11 has its invert silted in. The outlet channel from the blowoff contains fallen branches.

6. Seepage which apparently exits from the toe drains was noted near the drain outlet structure shown in Photo 5 and in the low area below the gatehouse. Both areas were wet and marshy below the toe, within 50 to 100 ft. of the base of the slope. Flow was evident but no indication of soil profile movement was observed.
7. Seepage was also evident at the embankment contact with the right abutment, at the level of the berm, as shown in Photo 7. Seepage flow at this location was estimated to be approximately 1 to 2 gpm. No evidence of soil particle movement was observed. The seepage condition at this location has been investigated by Metcalf & Eddy. The seepage observed on 1 May 1979 appeared to be similar to the condition described by Metcalf & Eddy in a report dated 28 December 1976. The protective casing at piezometer B-4 is broken.

c. Appurtenant Structures - The condition of the appurtenant structures are as follows:

Dike A appears to be in good condition, based on the visual observations outlined in the following remarks:

1. The visible portion of the upstream face has riprap wave protection consisting of cobbles to 5 ft. pieces, extending to the crest as shown in Photo No. 12. There are a few weeds growing in the riprap. Otherwise, the riprap appears sound and in stable condition.
2. The crest is an asphalt-paved roadway, with grass and weed covered shoulders as shown in Photo No. 13. the pavement appears to be in good condition, except for minor cracking.
3. The downstream slope has a mowed grass and weed cover. No evidence of sloughing, erosion or other instability was observed.
4. There is a wet, soft area downstream of the toe along the right half of the embankment. The wet area is defined by the presence of thick brush and small trees. This wet zone extends downstream about 200 ft. to a swampy area where there is ponded water. No evidence of flow or movement of soil particles was discernible.

The performance of Dikes B and C appears to be generally satisfactory. However, because of the presence of downstream seepage, the overall condition can be considered only fair. The observed conditions at Dikes B and C area are outlined by the following remarks:

1. The visible portion of the upstream face of each dike and the overflow portion of Dike B have riprap wave protection consisting of cobbles to 5 ft. pieces as shown by Photos 14 and 19. There are a few weeds growing in the riprap but generally the stones appear to be sound and in stable arrangement.

### SECTION 3: VISUAL INSPECTION

#### 3.1 Findings

- a. General - The Phase I visual examination of Cleveland Brook Reservoir Dam was conducted on 1 May, 1979.

In general, the dam, dikes and spillway can only be considered in fair condition due to observed seepage at various locations. The reservoir level at the time of the site examination was at elevation 1436.9.

Visual inspection checklist for the site visits are included in Appendix A and selected photographs are given in Appendix C.

- b. Dam - Visual observations indicate that the present performance of the Main Dam is, generally, satisfactory. However, because of seepage conditions observed at the right abutment, the overall condition of the dam can be considered only fair. The following remarks outline the observed condition of the Main Dam embankment.

1. The visible portion of the upstream slope has riprap consisting of cobbles to 5-ft. pieces extending to the crest as shown by Photo No. 3. Weeds were noted growing between the stones and a few stones were locally dislodged but generally the riprap appeared to be sound and in a stable arrangement.
2. The crest has a mowed grass cover and is slightly rutted as shown by Photo No. 2. There may be up to 0.5 ft. variation in crest elevation. The grassed portion of the crest is about 13 to 14 ft. wide.
3. The downstream slope, as shown in Photo No. 4, has a mowed grass cover with occasional cut weeds and stumps on the lower portion. There is some uncut brush on the rock toe, near the right end. Paved gutters along the berm are overgrown.
4. Two abandoned animal burrows were noted in the downstream slope. One was located just below the berm, near the gatehouse and one was about 300 ft. left of the gatehouse about 15 ft. below the crest. The latter hole was probed about 7 ft. horizontally into the embankment.
5. The lower portion of the downstream slope is somewhat irregular and varies an estimated 0.5 to 1.0 ft. from plane. However, no evidence of sloughing or other slope movement was discernible.

## SECTION 2: ENGINEERING DATA

- 2.1 Design - Design records for this dam are available at the offices of Metcalf & Eddy, 50 Staniford Street, Boston, Ma. Record drawings of this facility are available at both the offices of Metcalf & Eddy and the Department of Public Works, Pittsfield, Massachusetts. The record drawings contain the subsurface exploration performed at the site prior to construction. Copies of pertinent data on this facility are included in Appendix B of this report.
  - 2.2 Construction - Construction reports for this project are located at the offices of Metcalf & Eddy, 50 Staniford Street, Boston, MA.
  - 2.3 Operation - No operation records other than the inspection reports on the facility and water level readings at the reservoir were located. The design engineer, Metcalf & Eddy, completed a detailed investigation of seepage occurring near the east abutment of the existing dam and submitted their report in December 1976.
- 2.4 Evaluation
- a. Availability - Documents described above are available at the offices of Metcalf & Eddy, 50 Staniford Street, Boston, MA. A portion of these documents are on microfilm and require time to be made available. The original plans pertaining to the design and construction of the facility in 1948 are available at the Department of Public Works, Pittsfield, MA. The documents pertaining to the alteration to the dam and appurtenances which were done in 1963 are available at the offices of Metcalf & Eddy.
  - b. Validity - The record drawings for this project were in excellent agreement with the features observed in the field.
  - c. Adequacy - The available data, in combination with the visual inspection described in the following section, is adequate for the purposes of the Phase I investigation.

- (8) Cutoff -----Trench filled with "select impervious material"---
- (9) Grout Curtain -----None known-----
- h. Diversion and Regulating Tunnel -----None
- i. Spillways
- Main Spillway
- (1) Type-----Conc. broad crested weir w/provisions for flashboards
- (2) Length of weir-----80 ft
- (3) Crest elevation-----1435 (1437 w/flashboards)
- (4) Gates-----None
- (5) U/S Channel-----Inv. El. 1425.7 (Level)
- (6) D/S Channel-----Stilling basin
- Overflow Spillway
- (1) Type-----earth embankment with riprap protection on 16 ft. wide crest
- (2) Length of weir-----135 ft.
- (3) Crest Elevation-----1439
- j. Regulating Outlets - The 30-in. pipe reservoir drain is located at approximately the center of the drain. A reinforced concrete structure is located at the inlet end of the drain. The structure contains an inlet formed of concrete, a sluicegate at the upstream end of the pipe and the gate operator. The operating level for the valve is at elevation 1390 which is below the reservoir water level at the normal pond elevation. The inlet invert elevation is 1372. The reservoir drain discharges at the downstream toe of the dam through a flap valve into a reinforced concrete structure with concrete energy dissipators. The reservoir drain has not been maintained and since the gate operator is below the normal reservoir level, the facility is not considered to be operational. A blowoff pipe from the 30-in. water transmission main located approximately 450 feet from the downstream toe of the dam presently serves as the reservoir drain.

d. Reservoir Length (feet)

(1) Length of test flood pool-----	3550
(2) Length of Normal pool-----	3440
(3) Length of flood control pool-----	N/A

e. Storage (acre-feet)

(1) Normal pool-----	4,928
(2) Flood control pool-----	N/A
(3) Spillway crest pool with 2-ft of flashboards-----	5,230
(4) Top of dam-----	6,022
(5) Test flood pool-----	5,741

f. Reservoir Surface (acres)

(1) Normal pool-----	151
(2) Flood-control pool-----	N/A
(3) Spillway crest with 2-ft of flashboards-----	153
(4) Test flood pool-----	157
(5) Top of dam-----	162

g. Embankments

Dam

Dike A

Dikes B & C

(1) Type	-----Earth embankment-----		
(2) Length	1650 ft	690 ft	415 ft
(3) Height	71 ft max	17 ft max	11 ft max
(4) Top width & elev.	17.5 ft at elev. 1442.0	22 ft at elev. 1442.0	8 ft at elev. 1441.0
(5) Side slopes	7, 3 & 2:1 U/S 2.5 w/10 ft berm D/S	2:1	2:1
(6) Zoning	Impervious core w/semi-imper- vious and per- vious D/S zones	-----Impervious core----- w/pervious D/S zone	
(7) Impervious Core-----	central core of "select impervious material"-----		

- a. Drainage Area - The drainage area consists of 1.5 square miles of heavily forested and predominantly mountainous terrain. About 6 percent of the drainage area is flat upland marsh and 16 percent of the drainage area is Cleveland Brook Reservoir itself.
- b. Discharge at Dam Site - There are no records of discharges at the dam site.
  - (1) Outlet works size.....30-inch diameter at invert elevation 1372.
  - (2) Maximum known flood at damsite.....Unknown
  - (3) Ungated spillway capacity at top of dam (no flashboards)  
4,850 cfs @ 1442 elev.
  - (4) Ungated spillway capacity at test flood elev. (with 2 ft. flashboards)  
1,630 cfs @ 1440.35 elev.
  - (5) Overflow spillway capacity at top of dam  
1910 cfs @ 1442 elev.
  - (6) Overflow spillway capacity at test flood elevation  
570 cfs @ 1440.35 elev.
  - (7) Combined spillway capacity at test flood elev. (with 2 ft. flashboards)  
2,200 cfs @ 1440.35 elev.
  - (8) Total project discharge at test flood elevation (with 2 ft. flashboards)  
2,200 cfs @ 1440.35 elev.
- c. Elevation (NGVD)
  - (1) Streambed at centerline of dam-----1371
  - (2) Test flood tailwater----- below elev. 1435
  - (3) Upstream portal invert diversion tunnel-----N/A
  - (4) Normal pool-----1435
  - (5) Full flood control pool----- -N/A
  - (6) Spillway crest-----without flashboards---1435  
with flashboards---1437
  - (7) Design surcharge (Original Design)-----1438.7  
(assume center 30-ft of flashboards collapsed (el. 1435), and  
remaining 50 ft. at el. 1437)
  - (8) Top of dam-----1442
  - (9) Test flood design surcharge-----1440.35

- h. Design and Construction History - The present Cleveland Brook Reservoir Dam was designed in 1948 by Metcalf & Eddy Engineers, Boston, Massachusetts and constructed by Tuller Construction Co. in 1949. A note on the record drawing titled Main Dam - West Section Plan states the following: "Sheeted cut-off trench back-filled with selected impervious material. Trench abandoned between Sta. 10+46 and Sta. 11+76 because of flowing sand. Effective cut-off made at 160 ft (-) upstream from centerline of dam". In a letter dated February 10, 1949 from the design engineer to the Berkshire County Engineer, a copy of which is included in Appendix B, the following statement is made: "A previous formation of sand and gravel encountered under the upstream cutoff west of the brook has made it seem advisable to deepen the cutoff excavation to a depth of some 20 ft. below the brook level for a short distance west of the brook. It is expected that the work on this cutoff will proceed as soon as weather is favorable. In the west abutment, the Contractor has elected to use open cut excavation in lieu of the sheeted trench contemplated by the Contract drawings, and this will be carried somewhat deeper than originally planned to reach satisfactory impervious material."

In 1963, the firm of Metcalf & Eddy designed a modification to the facilities to increase the reservoir height 5 feet. Shortly thereafter, the dam, dikes and spillway were raised accordingly. Due to observed seepage near the right abutment in the Winter of 1975, the same firm investigated the condition and prepared a report for the City of Pittsfield in 1977.

- i. Normal Operational Procedures - There are no formal operational procedures currently in effect for this facility. The dam is operated as a water supply dam according to the need for water in the City of Pittsfield. It appears to be well maintained and there appears to be dialogue about the dam between the City and design engineers on an as need basis.

1.3

Pertinent Data - The elevation for the reservoir shown on USGS Quadrangle Peru, Mass., 1973 is elevation 1429. The spillway crest elevation prior to raising the dam was elevation 1430. It is not known whether the USGS Quadrangle shows the reservoir outline for the spillway crest prior to 1966 in which case there is a 1 foot differential or the reservoir outline after 1966 in which case the differential between the contract plans and the Quadrangle Sheet would be 6 feet. All elevations shown in this report, therefore, are based on the elevations shown on the record plans for the dam, dikes and spillway which are assumed to be on NGVD (National Geodetic Vertical Datum).

feet below normal dike crest. The crest width in the overflow section is 16 feet and protected by riprap placed on bank run gravel. The upstream and downstream slopes are also protected by riprap placed on washed stone and bank run gravel. The approach and discharge slope to the overflow section is 2 horizontal to 1 vertical, and is in the same plane as the non-overflow portions of the dike.

The two dikes, Dike B and C, are separated by a reinforced concrete spillway. The spillway has a weir length of 80 feet and a crest elevation of 1435.0. There are provisions for placing stoplogs to elevation 1437. The concrete weir and sidewalls of the spillway are gravity sections. The approach channel has an impervious soil blanket invert protected by 6 inches of bank run gravel. Immediately in front of the weir, rock ballast has been placed on approximately a 1 to 1 slope. Immediately downstream of the weir, the invert of the channel is a reinforced concrete slab abutting up against the former spillway weir for the reservoir. The former weir has a crest elevation of 1430 and serves somewhat as an energy dissipator. The concrete apron of the former weir extends down the channel another 12 feet from the old weir.

- c. Size Classification - The hydraulic height of the dam is approximately 70 feet and the estimated total storage capacity at the top of the dam is 6,022 acre-feet. According to guidelines established by the Corps of Engineers, the dam is classified in the intermediate category based on both the storage capacity and the height of dam.
- d. Hazard Classification - The results of the dam failure analysis indicates a high potential for loss of life and property. The flood wave would pass through moderate to high density development areas in the Town of Dalton and the City of Pittsfield. Scores of residential homes, industrial and commercial buildings, and at least one high school would be affected. Over ten roadway bridges and about 7 mill dams would be overtopped. Consequently, the dam is in the "high" hazard classification.
- e. Ownership - The dam is owned by the City of Pittsfield, Massachusetts. The Owner is represented by Mr. Gerald Doyle, Commissioner of Public Works, 70 Alden Street, City Hall, Pittsfield, MA 01201 (Phone: 413/499-1100).
- f. Operator - Mr. Alfonso Yovis, Superintendent of Water Department is assigned responsibility for operation of the dam. His address is Water Department, City of Pittsfield, 235 Tyler Street, Pittsfield, MA 01201 (Phone: 413/443-6112).
- g. Purpose of the Dam - Cleveland Brook Reservoir is part of the water supply system for the City of Pittsfield, Massachusetts.

formed by a piece of 24-inch cast iron pipe through the control tower walls. Reinforced concrete structures with 2-inch cast iron pipe screens in front form the inlets to the 30-inch pipe intakes. The 24-inch cast iron pipe intake is protected with a piece of cast iron grading. The intake invert elevations are 1385, 1400 and 1415. The gate structure or control tower is divided into 2 chambers by a reinforced concrete wall. Three openings protected by screens, each 5 feet 4 inches high and 3 feet 6 inches wide penetrate the concrete dividing wall. The invert elevation for the openings is elevation 1385. The 30-inch water transmission main leading from the downstream chamber is gated within the control tower. The floor stands for the gate valves are manually operated and located on the operating floor within the control tower at elevation 1438. A bridge from the crest of the dam provides access to the control tower. The 30-inch water supply transmission main has a blowoff approximately 450 feet from the downstream toe of the dam. The 30-inch transmission main is also valved just downstream of the blowoff pipe.

Dike A has a maximum height of approximately 17 feet and a crest width of 22 feet. A paved roadway goes over the crest of the dike. The upstream and downstream slopes are 1 vertical to 2 horizontal. The upstream face of the dike is protected by riprap placed on washed stone. The downstream face of the dike is loamed and seeded. The core of the dike is constructed of impervious material with pervious material at the downstream toe. A cutoff trench filled with impervious material to a point 6 feet below the normal foundation of the dam is present at or near the center of the dike.

A 78-inch RCP diversion conduit, which may provide additional flow into the reservoir from Cady Brook and the East Branch of the Housatonic River, passes under Dike A and outlets into Cleveland Brook Reservoir. A reinforced concrete energy dissipator structure, having an invert elevation of 1408.0, forms the transition between conduit and reservoir. The structure is located approximately 70 feet into the reservoir from the toe of Dike A. Flow regulation is accomplished at the diversion structures located on Cady Brook (inv. elev. 1471.0) and at the East Branch of the Housatonic River (inv. elev. 1471.5). No means of flow regulation is present at Cleveland Brook Reservoir.

Dikes B and C at the spillway structure have a maximum height of approximately 11 feet. Dike C and the non-overflow portions of Dike B have a crest width of 8 feet and side slopes of 1 vertical to 2 horizontal. The upstream portion of these dikes are protected by riprap placed on washed stone and bank run gravel. The crest and downstream faces of the dikes are loamed and seeded. The core of the dikes are constructed of impervious material with a small area of pervious material at the downstream toe. A cutoff of select impervious material extending approximately 3 feet below the normal foundation of the dike is present at the centerline. Dike B, the most northerly of the two dikes, has a 135 foot long overflow section. The crest elevation of the overflow section is elevation 1439, which is 2

b. Description of Dam and Appurtenances - The impoundment structures at Cleveland Brook Reservoir include a 1,650 foot long earth dam, an adjacent 690 foot long earth dike (Dike A) and a 415 foot long earth dike and spillway complex. The water supply intakes, the water supply gate structure and the reservoir drain are located at the main dam. A diversion conduit passes under Dike A and discharges into Cleveland Brook Reservoir near the dike's upstream face. The earth embankments on each side of the 80 foot long concrete spillway are known as Dike B and Dike C. A portion of Dike B is depressed for 135 feet in length to form an overflow spillway.

The main dam is a zoned earth embankment with a maximum height of 71 feet and a crest width of 17-1/2 feet. The upstream slope varies with a 1 vertical to 7 horizontal slope below elevation 1390, 1 vertical to 3 horizontal below elevation 1420 and 1 vertical to 2 horizontal below the crest of the dam at elevation 1442. The slope of the downstream face of the dam is 1 vertical to 2-1/2 horizontal with a 10-foot berm approximately at mid-height of the dam. The upstream face of the dam is protected with riprap bedded on washed stone in the upper regions and bank run gravel in the lower regions, all founded on a selected impervious blanket. The crest of the dam and the downstream face of the dam is loamed and seeded. The main core of the dam is of impervious material with a semi-impervious material and impervious material towards the downstream base. Selected pervious material is utilized as a toe drain for the dam. A cutoff trench of selected impervious material was placed along the upstream toe of the dam and at the higher portions of the dam an additional cutoff trench of selected impervious material was placed near the center of the dam.

A reservoir drain passes under the dam at approximately the center of the dam. The drain is a 30-inch pipe with concrete seep collars. A reinforced concrete structure is located at the inlet end of the drain. The structure contains an inlet formed of concrete, a sluicegate at the upstream end of the pipe and a manual gate operator. The operating level for the valve is at elevation 1390 which is below the reservoir water level at the normal pond elevation. The inlet invert elevation is 1372. The reservoir drain discharges at the downstream toe of the dam through a flap valve into a reinforced concrete structure with concrete energy dissipators.

A 30-inch water supply transmission main passes under the dam at approximately 1/3 of the distance in from the right abutment to a 15-foot internal diameter gate structure or control tower. There are three intakes to the structure. The two lower intakes are 30 inch diameter cast iron pipes while the upper intake is

NATIONAL DAM INSPECTION PROGRAM  
PHASE I INSPECTION REPORT

CLEVELAND BROOK RESERVOIR DAM  
MA 00225

SECTION 1: PROJECT INFORMATION

1.1 General

- a. Authority - Public Law 92-367, 8 August 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region.

Camp Dresser & McKee Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Massachusetts. Authorization and notice to proceed was issued to Camp Dresser & McKee Inc. under a letter of 27 March 1979, from Colonel John P. Chandler, Corps of Engineers. Contract No. DACW 33-79-C-0053 has been assigned by the Corps of Engineers for this work. Haley and Aldrich, Inc. has been retained by Camp Dresser & McKee Inc. for the soils and geological portions of the work.

- b. Purpose - The primary purpose of the investigation is to:

- (1) Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.
- (2) Encourage and assist the States to initiate quickly effective dam safety programs for non-Federal dams.
- (3) Update, verify and complete the National Inventory of Dams.

1.2 Description of Project

- a. Location - Cleveland Brook Reservoir Dam is located on the south side of Frank Schnopps Road between Old Winsor Road and Stone House Road in the Town of Hinsdale, Massachusetts, as shown on the report's Location Map. The dam is at the headwaters of Cleveland Brook approximately 2 miles upstream of its confluence with the East Branch of the Housatonic River in Dalton, Massachusetts. The coordinates for the dam are 73 degrees-06.9 minutes longitude and 42 degrees-28.2 minutes latitude.

## SECTION 4: OPERATIONAL PROCEDURES

- 4.1 Procedures - Although there is an informal routine for the operation of the dam, there is no written procedure.
- 4.2 Maintenance of Dam - It appears that there has been systematic maintenance of the dam and dike embankments.
- 4.3 Maintenance of Operating Facilities - The maintenance of the operating facilities is performed primarily on a demand basis. There is no written formal procedure established for the maintenance of the operating facilities. The operating facilities are primarily for the transmission of water to the City of Pittsfield and are operated as a part of performing this task. It was reported that the reservoir drain is not used on a regular basis and it is not maintained in operating condition. The center 30-ft. of the 80-ft. long by 2-ft high flashboards were designed to fail under an 0.5-ft. head.
- 4.4 Description of Any Warning System in Effect - There is no formal established warning system or emergency preparedness plan in effect for this structure.
- 4.5 Evaluation - Maintenance of the facility is being performed on an informal basis. The dam, dikes and spillway appear to have had systematic maintenance. It is recommended that a written maintenance procedure be compiled based on the maintenance work currently being performed in an informal manner. The maintenance procedure should include the maintenance of the reservoir drain. Formal operational procedures and warning systems and emergency preparedness plans should be established for the dam.

## SECTION 5: HYDRAULIC/HYDROLOGIC

### 5.1 Evaluation of Features

- a. General - The impoundment structures at Cleveland Brook Reservoir include a 1,650 foot long earth dam, a 690 foot long earth dike and a 415 foot long earth dike including an 80 foot long concrete spillway. The earth embankments on each side of the concrete spillway are known as Dike B and Dike C. The crest of Dike B is depressed (El. 1439) for 135 feet in length to form an overflow spillway. Crest elevation of Dike B and C is 1441 while the crest of Dike A and the main dam is at elevation 1442. The spillway crest is at elevation 1435 with no flashboards. Up to 2 feet of flashboards may be placed at the spillway.

Cleveland Brook Reservoir is located about at the headwaters of Cleveland Brook, approximately 2 miles upstream of its confluence with the East Branch of the Housatonic River. The reservoir serves as a water supply to the City of Pittsfield located about 7 miles downstream. Basically, the reservoir is a high-surcharge-low spillage project.

- b. Design Data - Metcalf & Eddy Inc., 50 Stanford Street, Boston, Massachusetts designed Cleveland Brook Reservoir in 1948, as well as the subsequent modifications in 1963. Hydraulic and hydrologic design data for the reservoir is in storage and not readily available. Some hydraulic/hydrologic information was retrieved and is presented in Section 1.3 and in Appendix B. In addition, a complete set of plans for the project was obtained from the City of Pittsfield and selected drawings are included in Appendix B. According to the design data included in Appendix B-19 and B-20, the design flood peak inflow was 2,000 cfs.
- c. Experience Data - No records of past floods are available for the dam site. Frank Schnopps Road, located about 90 feet downstream of the spillway, is normally flooded during the spring runoff.
- d. Visual Observation - At the time of the inspection in 1 May 1979, there was 2 feet of flashboards in place at the spillway. Both the main spillway and the overflow spillway appeared in good hydraulic condition. It was noted that the twin 18-inch culverts under Frank Schnopps Road provide limited hydraulic capacity and major discharges would flow over the roadway.

e. Test Flood Analysis - Based upon the Corps of Engineers Guidelines, the recommended test flood for the size (intermediate) and hazard potential (high) is the PMF (Probable Maximum Flood). The PMF was determined using the Corps of Engineers Guidelines for "Estimating Maximum Probable Discharges" in Phase I Dam Safety Investigations. The watershed terrain is generally "rolling" with a small marshy area in the southwest corner. The peak inflow rate for the 1.5 square mile watershed was determined to be 2,200 cfs/sq. mi. which yields a PMF inflow of about 3,350 cfs.

The evaluation of the effects of the test flood inflow is based on a spillway crest elevation of 1437. This assumes 2 feet of flashboards in place and corresponds to field conditions at the time of the inspection. Given this assumption, and the storage and spillway characteristics of the reservoir, the routed test flood outflow is about 2,200 cfs at a stage of 1440.35. The test flood overtops the overflow spillway by 1.35 feet with 1.65 feet of freeboard remaining with respect to the main dam and Dike A, and 0.65 feet of freeboard with respect to Dikes B and C. The depth of water above the flashboards is about 3.35 feet.

The immediate downstream channel has adequate capacity to carry the test flood without creating tailwater effects at the main and overflow spillways. Some flooding will occur at Frank Schnopps Road and at areas further downstream.

f. Dam Failure Analysis - Based on Corps of Engineers Guidelines for estimating Dam Failure Hydrographs, and assuming a failure would occur along 40 percent of the mid-height length of the dam structure (434 feet), the peak failure outflow is estimated to be about 427,000 cfs. As a result of a dam failure, Old Windsor Road would be over-topped by about 25 feet in the flatter reaches and about 20 feet in the steeper reaches. About twelve (12) dwellings would be affected along the reach where Cleveland Brook winds around Old Windsor Road to the Wahconah Country Club. Cleveland Brook joins the East Branch of the Housatonic River at the Wahconah Country Club. The depth of flow through the country club would be about 25 feet at the center-line of the channel. The Wahconah Regional High School and several dwellings on the left bank plus over forty (40) dwellings on the right bank would be affected. The water depth over the bridge on the road connecting Routes 8 and 9 just downstream of the country club would be in excess of 10 ft. The dam failure outflow would then flow through Center Pond affecting scores of dwellings on both sides of the channel the Town of Dalton affecting scores of dwellings on both sides of the channel banks. The dam at Center Pond, as well as the six (6) mill dams downstream, would be overtopped. Five mills, together with many homes and a sewage disposal area would be affected between Center Pond and Hubbard Avenue. In the reach between Hubbard Avenue and East Street, several industrial buildings and a few dwellings would be affected. The estimated water surface elevation at the Penn Central Railroad bridge, which is just upstream of East Street, would be about 994 feet but the bridge would not be overtopped.

Downstream of East Street the dam failure outflow would wind through the City of Pittsfield overtopping several bridges and affecting development on both banks of river before reaching a point beyond Holmes Road where no further hazard would be expected.

It is clear that the dam failure outflow resulting from the failure of the Cleveland Brook Reservoir Dam would create a high potential for loss of life and property. Accordingly, the dam is classified in the high hazard category.

## SECTION 6: STRUCTURAL STABILITY

### 6.1 Evaluation of Structural Stability

- a. Visual Observations - There was no visible evidence of dam, dike or spillway instability during the site examination on 1 May, 1979. Seepage was observed at the downstream toe of the right abutment of the main dam and at dikes B and C. The condition at the first main dam was first reported late in 1975 and observed during the site examination. Based on the report on the seepage and observations made during the visual examination, it is not considered to pose an immediate hazard to the stability of the downstream slope.
- b. Design and Construction Data - The design drawings for the construction and later modification of Cleveland Brook Reservoir Dam, copies of which are included in Appendix B, show cross-sections for the dam and dikes that incorporate the various usual features of dam design. While construction data for this project has not been reviewed, the design configuration appears reasonable. Assuming that the dam was constructed in accordance with the drawings, using materials with satisfactory permeability and filter characteristics, it would be expected to be adequately stable under static loading conditions.
- c. Operating Records - No records of embankment performance under prior maximum loading conditions are available. No instrumentation observations are available except for piezometer data obtained by Metcalf & Eddy in connection with their investigations of seepage at the right abutment of the Main Dam. These piezometer data, as reported by Metcalf & Eddy, do not indicate the need for urgent remedial measures with regard to stability of the Main Dam embankment.
- d. Post-Construction Changes - The height of the dam, dikes B and C and the spillway were raised 5 feet in 1966. Dike A was raised 6 feet during the same modification. No other post-construction changes are known.
- e. Seismic Stability - Cleveland Brook Reservoir Dam is located near the boundary between Seismic Zones 1 and 2 and in accordance with Recommended Phase I Guidelines does not warrant seismic analysis.

## SECTION 7: ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

### 7.1 Dam Assessment

- a. Condition - The visual examination of the Cleveland Brook Reservoir Dam and dike embankments revealed no conditions which warrant urgent remedial action. However, because of seepage conditions observed at Main Dam and at Dikes B and C, the overall condition of the project can be considered only fair.
- b. Adequacy of Information - The evaluation of the dam and dike embankments has been based primarily on the visual examination, consideration of available documents and past performance and application of engineering judgement. Generally, the information available or obtained was adequate for the purposes of the Phase I assessment. However, it is recommended that additional information relative to embankment seepage be obtained as outlined in Section 7.2.
- c. Urgency - The recommendations for additional investigations and remedial measures, outlined in Sections 7.2 and 7.3, respectively, should be undertaken by the Owner within one year after receipt of this report.
- d. Need for Additional Investigations - Additional investigations should be performed as outlined in Section 7.2.

### 7.2 Recommendations

It is recommended that the Owner arrange for the following investigations to be performed by a qualified registered professional engineer.

1. Evaluate the significance of the seepage conditions observed along the toe of the Main Dam and downstream from Dikes B and C. Consideration should be given to the effects of seepage conditions relative to long term embankment stability and an assessment of the need for remedial measures should be made.
2. Continue monitoring of piezometers installed near the right abutment of the Main Dam and implement remedial measures to control the seepage condition at that location.

The Owner should implement corrective measures as required, based on the results of the above engineering evaluations.

### **7.3 Remedial Measures**

- a. Operation and Maintenance Procedures - It is recommended that the following remedial work be undertaken by the owner to correct deficiencies noted during the visual examination.
1. Continue to mow slopes at least once a year to permit visual inspection.
  2. Animal burrows in the embankments should be filled. An annual inspection should be made to check for burrowing activity and corrective action should be taken as required.
  3. Seepage conditions should be visually monitored on a regular basis at least until an assessment of the need for remedial measures is completed.
  4. Repair protective casing at piezometer B-4.
  5. Remove weed growth from concrete joints at the main spillway and remove debris from spillway apron.
  6. Repair deteriorated concrete, clean debris from the base slab and clean and paint the flap valve at the reservoir drain outlet structure. Check the outlet valve to ensure it is operational.
  7. Place stone at the dam end of the access bridge to the gatehouse to bring approach to walkway grade.
  8. Remove soil and vegetation from the top of the blowoff structure and clean the outlet channel.
  9. Develop a formal maintenance program, operational procedure, emergency preparedness plan and warning system in cooperation with downstream communities.
  10. Institute a program of annual technical inspections.

### **7.4 Alternatives**

There are no practical alternatives recommended.

APPENDIX A

INSPECTION TEAM ORGANIZATION AND CHECK LIST

Page No.

VISUAL INSPECTION PARTY ORGANIZATION

A-1

VISUAL INSPECTION CHECK LIST

Embankment: Dam	A-2, A-3
Embankment: Dike A	A-4
Embankment: Dike at Spillway (Dikes B & C)	A-5
Main Spillway	A-6
Outlet Works (Blow Off)	A-7
Control Tower & Service Bridge	A-8
Special Structure (Drainage Outlet Structure)	A-9

VISUAL INSPECTION PARTY ORGANIZATION

NATIONAL DAM INSPECTION PROGRAM

DAM: CLEVELAND BROOK RESERVOIR DAM

DATE: 1 MAY 1979

TIME: 1345

WEATHER: Broken Clouds - 65° F 10 to 15 mph wind

WATER SURFACE ELEVATION UPSTREAM: 2' of flashboards in place - water  
is one inch below top of flashboards

STREAM FLOW: No Flow

INSPECTION PARTY:

1. Roger H. Wood, CDM
2. Joseph E. Downing, CDM
3. John Critchfield, H&A
4. Douglas G. Gifford, H&A
5. \_\_\_\_\_

PROJECT FEATURE	INSPECTED BY	REMARKS
1. <u>Spillway and Gatehouse</u>	<u>Roger H. Wood</u>	
2. <u>Embankments</u>	<u>Douglas G. Gifford</u>	
3. _____		
4. _____		

PRESENT DURING INSPECTION:

1. John Razzano - Pittsfield Water Dept.
2. \_\_\_\_\_
3. \_\_\_\_\_

VISUAL INSPECTION CHECK LIST  
NATIONAL DAM INSPECTION PROGRAM

DAM: CLEVELAND BROOK RESERVOIR DAM  
EMBANKMENT: DAM

DATE: 1 MAY 1979  
BY: DGG & JWC

CHECK LIST	CONDITION
1. Upstream Slope a. Vegetation b. Sloughing or Erosion c. Rock Slope Protection - Riprap Failures d. Animal Burrows	1. a. Few weeds growing in riprap. b. None observed. c. Riprap (cobbles to 5 ft. pieces) to crest. Generally good condi- tion, a few stones locally dis- lodged. d. None.
2. Crest a. Vegetation b. Sloughing or Erosion c. Surface Cracks d. Movement or Settlement	2. a. Grass, mowed. b. Slightly rutted. c. None observed. d. Crest elevation varies up to + 0.5 ft. (est.).
3. Downstream Slope a. Vegetation b. Sloughing or Erosion c. Surface Cracks d. Animal Burrows e. Movement or Cracking near toe f. Unusual Embankment or Downstream Seepage g. Piping or Boils h. Foundation Drainage Features i. Toe Drains	3. a. Grass, mowed on upper portion. Lower portion has grass, weeds (cut) with occasional stump cut flush, up to 8 in. dia. Some brush on rock toe near right end. Paved gutters overgrown. b. Slope surface is irregular (est. 0.5 to 1.0 ft. variation from plane), esp. lower portion. No apparent sloughing. c. None observed. d. Two abandoned burrows noted. One just below berm, below gatehouse, one about 300 ft. left of gate- house and about 15 ft. below crest. The later hole about 7 ft. into slope. e. None observed. f. Seepage from toe drain exits in area of drain outlet structure and in low area below gatehouse. Both areas wet and marshy, within 50 to 100 ft. of toe. Flow evi- dent but no apparent soil move- ment. Seepage also emerging at embankment contact with right abutment, at level of berm. Seepage flowing along contact at toe at 1-2 gpm. No apparent soil movement. g. None observed.
4. General a. Lateral Movement b. Vertical Alignment c. Horizontal Alignment d. Condition at Abutments and at Structures e. Indications of Movement of Structural Items f. Trespassing g. Instrumentation Systems	

VISUAL INSPECTION CHECK LIST  
NATIONAL DAM INSPECTION PROGRAM

DAM: CLEVELAND BROOK RESERVOIR DAM

DATE: 1 MAY 1979

EMBANKMENT: DIKE A

BY: DGG & JWC

CHECK LIST	CONDITION
1. Upstream Slope a. Vegetation b. Sloughing or Erosion c. Rock Slope Protection - Riprap Failures d. Animal Burrows	1. a. Weeds growing in riprap. b. None observed. c. Riprap to crest, cobbles to 5 ft. pieces, good condition. d. None observed.
2. Crest a. Vegetation b. Sloughing or Erosion c. Surface Cracks d. Movement or Settlement	2. a. Paved road 22 ft. wide, grass and weeds along edges. b. None observed. c. Occasional cracks in asphalt pavement. d. None observed.
3. Downstream Slope a. Vegetation b. Sloughing or Erosion c. Surface Cracks d. Animal Burrows e. Movement or Cracking near toe f. Unusual Embankment or Downstream Seepage g. Piping or Boils h. Foundation Drainage Features i. Toe Drains	3. a. Grass & weeds, mowed. b. None observed. c. None observed. d. None observed. e. None observed. f. Area extending D/S from right half of embankment is wet and soft. No evidence of flow or soil movement. Wet area extends about 200 ft. D/S to swampy area, where water is ponded. g. None observed. h., i. None known.
4. General a. Lateral Movement b. Vertical Alignment c. Horizontal Alignment d. Condition at Abutments and at Structures e. Indications of Movement of Structural Items f. Trespassing g. Instrumentation Systems	4. a. None observed. b. Good. Crest approx. 5.0 ft. above water. c. Dike curved. Crest width approx. 25 ft. D/S slope approx. 2H to 1V. d. Good. e. None observed. f. Minor. g. None known.

VISUAL INSPECTION CHECK LIST  
NATIONAL DAM INSPECTION PROGRAM

DAM: CLEVELAND BROOK RESERVOIR DAM

DATE: 1 MAY 1979

EMBANKMENT: DIKE AT SPILLWAY (DIKES B & C)

BY: DGG & JWC

CHECK LIST	CONDITION
1. Upstream Slope a. Vegetation b. Sloughing or Erosion c. Rock Slope Protection - Riprap Failures d. Animal Burrows	1. a. Grass mowed. b. None observed. c. Riprap from cobble size to 3 ft. extends to crest level. d. None observed.
2. Crest a. Vegetation b. Sloughing or Erosion c. Surface Cracks d. Movement or Settlement	2. a. Grass, mowed, central 3.0 ft. at dike B utilized as emergency spillway; riprap from cobble size to 3 ft. placed on spillway area. b., c., d. None observed.
3. Downstream Slope a. Vegetation b. Sloughing or Erosion c. Surface Cracks d. Animal Burrows e. Movement or Cracking near toe f. Unusual Embankment or Downstream Seepage g. Piping or Boils h. Foundation Drainage Features i. Toe Drains	3. a. Grass mowed. b., c., e., e. None observed. f. Subgrade of roadway below dike C saturated; source could be com- bination of seepage beneath dike C and runoff from marshy high ground beyond roadway. Some seep- age at downstream toe at left training wall at dike B; no soil particle movement observed. g. None observed. h., i. None known.
4. General a. Lateral Movement b. Vertical Alignment c. Horizontal Alignment d. Condition at Abutments and at Structures e. Indications of Movement of Structural Items f. Trespassing g. Instrumentation Systems	4. a. None observed. b. Dike B crest 3.2 ft. above water level; emergency spillway top of riprap 2.0 $\pm$ ft. above water level; overtopping flow would begin 1.0 $\pm$ ft. below top of riprap. c. Consistent with design; no dis- placement noted. d. Good. e. None observed. f. Minor; tire tracks in grassed area downstream of emergency spillway. g. None observed.

VISUAL INSPECTION CHECK LIST  
NATIONAL DAM INSPECTION PROGRAM

DAM: CLEVELAND BROOK RESERVOIR DAM

DATE: 1 MAY 1979

SPILLWAY: MAIN

BY: R. WOOD

CHECK LIST	CONDITION
1. Approach Channel a. General Condition b. Obstructions c. Log Boom etc.	1. a. Excellent. b. None c. None
2. Weir a. Flashboards b. Weir Elev. Control (Gate) c. Vegetation d. Seepage or Efflorescence e. Rust or Stains f. Cracks g. Condition of Joints h. Spalls, Voids Or Erosion i. Visible Reinforcement j. General Struct. Condition	2. a. 2' of flashboards in place good condition. b. None except flashboards. c. Minor (grass in joints). d. Surface wet - none observed. e. Surface wet - none observed. f. Surface wet - none observed. g. Generally good see also c. h. Laitance flaking off several locations. i. None observed. j. Very good.
3. Discharge Channel a. Apron b. Stilling Basin c. Channel Floor d. Vegetation e. Seepage f. Obstructions g. General Struct. Condition	3. a. Concrete apron - much grass in joints, some rocks on apron. b. Concrete sill, few spalls left side - appears to be from vandals with rocks. c. Immediate channel well grassed to road. d. See c. e. Not observable. f. Channel downstream of road overgrown many young trees. g. Spillway itself and drop inlet in good condition.
4. Walls a. Wall Location (1) Vegetation (2) Seepage or Efflorescence (3) Rust or Stains (4) Cracks (5) Condition of Joints (6) Spalls, Voids or Erosion (7) Visible Reinforcement (8) General Struct. Condition	4. a. Side Walls (1) None observed. (2) Seepage at junction of new & old concrete (at face). Seepage from behind or just below D/S end of walls. (3) None observed. (4) Shrinkage cracks & surface crazing right wall. (5) Construction joints cracking. (6) None observed. (7) None observed. (8) Good.

VISUAL INSPECTION CHECK LIST  
NATIONAL DAM INSPECTION PROGRAM

AM: CLEVELAND BROOK RESERVOIR DAM

DATE 1 MAY 1979

OUTLET WORKS: BLOW OFF

BY: R. WOOD

HECK LIST	CONDITION
• Inlet	1. See control tower.
a. Obstructions	
b. Channel	2. a. Valve vaults - concrete moss covered.
c. Structure	b. N/A
d. Screens	c. N/A
e. Stop Logs	d. Valves not operated recently.
f. Gates	e. Buried, not observable.
• Control Facility	f. None observed.
a. Structure	3. a. Concrete in good condition moss covered.
b. Screens	b. None observed.
c. Stop Logs	c. Invert silted, branches in outlet channel.
d. Gates	d. None observed.
e. Conduit	4. Gates manually operated.
f. Seepage or Leaks	a. - f. Not applicable.
• Outlet	
a. Structure	
b. Erosion or Cavitation	
c. Obstructions	
d. Seepage or Leaks	
• Mechanical and Electrical	
a. Crane Hoist	
b. Hydraulic System	
c. Service Power	
d. Emergency Power	
e. Lighting	
f. Lightning Protection	
• Other	

## 12. Remarks &amp; Recommendations: [Fully Explain]

Mr. L. Newbill, J. Pierce, and A. Gerlach, from the Pittsfield Water Department were present at the inspection.

The dam appears to be in good condition. There is no settlement in the embankment or sloughing on the slopes. The top of the dam and the downstream slope are well mowed. There is a fairly heavy brush growth on the lower level near the toe, but is of minor concern.

The spillway is in good condition, at the present time there are 24" of flash boards in place. There is no evidence of cracks, spalling, or seepage.

The Pittsfield Water Department is doing a good job in checking and maintaining this dam.

## 13. Overall Condition:

1. Safe
2. Minor repairs needed \_\_\_\_\_
3. Conditionally safe - major repairs needed \_\_\_\_\_
4. Unsafe \_\_\_\_\_
5. Reservoir impoundment no longer exists [explain] \_\_\_\_\_

Recommend removal from inspection list \_\_\_\_\_

L-168 A

- 2 -

DAM NO. 1-2-132-4

8. Downstream Face of Dam: Condition: 1. Good X 2. Minor Repairs \_\_\_\_\_  
3. Major Repairs \_\_\_\_\_ 4. Urgent Repairs \_\_\_\_\_

Comments: \_\_\_\_\_

9. Emergency Spillway: Condition: 1. Good \_\_\_\_\_ 2. Minor Repairs \_\_\_\_\_  
3. Major Repairs \_\_\_\_\_ 4. Urgent Repairs \_\_\_\_\_

Comments: \_\_\_\_\_

10. Water level at time of inspection: 8 ft. above \_\_\_\_\_ below X \_\_\_\_\_.  
top of dam \_\_\_\_\_.  
principal spillway X \_\_\_\_\_.  
other \_\_\_\_\_.

11. Summary of Deficiencies Noted:

- Growth [Trees and Brush] on Embankment X \_\_\_\_\_.  
Animal Burrows and Washouts \_\_\_\_\_.  
Damage to slopes or top of dam \_\_\_\_\_.  
Cracked or Damaged Masonry \_\_\_\_\_.  
Evidence of Seepage \_\_\_\_\_.  
Evidence of Piping \_\_\_\_\_.  
Erosion \_\_\_\_\_.  
Leaks \_\_\_\_\_.  
Trash and/or debris impeding flow \_\_\_\_\_.  
Clogged or blocked spillway \_\_\_\_\_.  
Other \_\_\_\_\_.

## INSPECTION REPORT - DAMS AND RESERVOIRS

1. Location: City/Town HINSDALE. Dam No. 1-2-132-4.  
 Name of Dam Cleveland Reservoir. Inspected by: R D Julian.  
 Date of Inspection 9-10-72.
2. Owner/s: per: Assessors \_\_\_\_\_.  
 Reg. of Deeds \_\_\_\_\_ Pers. Contact \_\_\_\_\_.
1. City of Pittsfield City Hall Pittsfield, MA 499-1100  
 Name St. & No. City/Town State Tel. No.
2. Name St. & No. City/Town State Tel. No.
3. Name St. & No. City/Town State Tel. No.
3. Caretaker [if any] e.g. superintendent, plant manager, appointed by absentee owner, appointed by multi owners.  
Louis Newbill City Hall Pittsfield, MA 499-1100  
 Name St. & No. City/Town State Tel. No.
4. No. of Pictures taken 3.
5. Degree of Hazard: [if dam should fail completely]\*  
 1. Minor \_\_\_\_\_ 2. Moderate \_\_\_\_\_  
 3. Severe \_\_\_\_\_ 4. Disastrous x.
- \*This rating may change as land use changes [future development]
6. Outlet Control: Automatic \_\_\_\_\_ Manual x.  
 Operative x yes: \_\_\_\_\_ no: \_\_\_\_\_.
- Comments: \_\_\_\_\_
7. Upstream Face of Dam: Condition:  
 1. Good x 2. Minor Repairs \_\_\_\_\_.  
 3. Major Repairs \_\_\_\_\_ 4. Urgent Repairs \_\_\_\_\_.
- Comments: \_\_\_\_\_

## INSPECTION OF DAMS

City or Town of Hinsdale Date June 11, 1971  
Name of Dam Cleveland Reservoir Inspector R. Northrup & P. Fezzie  
Owner City of Pittsfield Address City Hall, Pittsfield, Mass.  
Caretaker City of Pittsfield Address City Hall, Pittsfield, Mass.  
Location South of Frank Schnopp's Road.  
Type of Dimensions Earth fill 1600' long, 71' high. Road over top.

Spillway, type and size Concrete 80' long, 5' freeboard.

Outlets, type and size 30" supply, 30" feed.

Flashboards, type and height 24" wood.

Date Built 1949 Condition Good

When last repaired 1963 By whose orders Owners

Nature of Repairs Level raised 5' adding 350 MG to capacity.

Purpose of Dam Water supply.

Approximate storage of water 1.575 billion gallons.

Approximate area of water shed Small diversion area has 11 square miles.

Possible damage due to failure of dam Disastrous.

Remarks Water 8" below top of flashboards. Growth on toe of embankment. Small amount of seepage at isolated spots on toe of embankment. Unable to ascertain whether seepage or surface runoff causes these isolated wet spots.

Recommendations Check toe of embankment periodically for signs of serious seepage.

Growth at toe is not serious and helps to prevent erosion.

FHIC

**COUNTY OF BERKSHIRE, MASS.**  
**INSPECTION OF DAMS**

City or Town of Hinsdale Date 12, August 1966

Name of Dam Cleveland Inspector Louis J. Diamond

Owner City of Pittsfield Address 33 Pearl St. Tel  
John Daniels Comm. P.W.

Caretaker Albert Goerlach Address Hinsdale, Mass. Tel

Location S.W. Cor. of Hinsdale.

Type and Dimensions Earth fill-1600' lg. 71' high. (66)

Spillway, type and size Conc. 80' lg. 5' freeboard.

Outlets, type and size 30" supply-30" feed.

Flashboards, type and height 24" wood.

Date Built 1948-49 Condition Good-Excellent

When last repaired 1963 By whose orders Owners  
Added 350,000,000, gals to capacity.

Nature of Repairs Raised level 5'

Purpose of Dam Water supply-City of Pittsfield

Approximate storage of water 1,525,000,000 gals.

Approximate area of watershed Small Diversion area has 11 sq. mi.

Possible damage due to failure of dam Disastrous

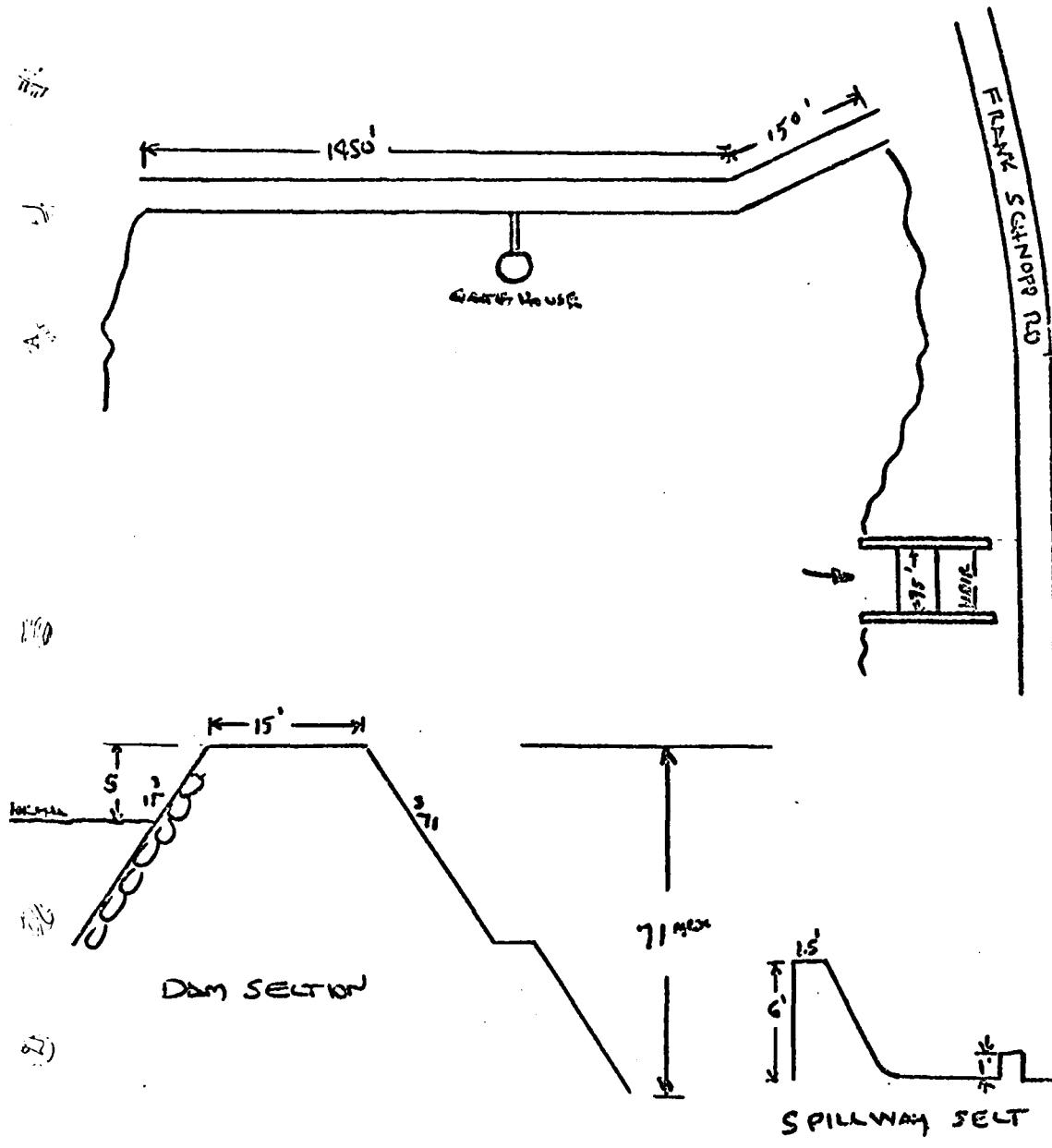
Remarks Water 12" below lip of conc. spillway.

Recommendations Growth on top and slopes should be removed.  
Move growth developing in rip-rap near gatehouse.



APPENDIX B-5

CLEVELAND RIVER  
4 1-2-132-4



APPENDIX B-4

L-169 A

DAM NO. 1-2-132-4.

10. Risk to life and property in event of complete failure.

No. of people 500+.

No. of homes 100±.

No. of Businesses 2.

No. of Industries 1. Type Papermaking.

No. of Utilities \_\_\_\_\_ Type \_\_\_\_\_.

Railroads \_\_\_\_\_.

Other dams Byron Weston.

Other Regional High School.

11.

Attach Sketch of dam to this form showing section and plan on 8-1/2" x 11" sheet.

L-169

DESCRIPTION OF DAM

DISTRICT ONE.

Submitted by R D Jordan Dam No. 1-2-132-4

Date 9-23-72 City/Town HINSDALE

Name of Dam Cleveland Reservoir

1. Location: Topo Sheet No. 5-B.  
Provide 8-1/2" x 11" in clear copy of topo map with location of Dam clearly indicated.
2. Year built: 1949. Year/s of subsequent repairs 1963
3. Purpose of Dam: Water Supply  Recreational .  
Irrigation . Other .
4. Drainage Area: 11 sq. mi.  acres.
5. Normal Pending Area:  Acres; Avg. Depth .  
Impoundment: 1.575 Bill. gals; acre ft.
6. No. and type of dwellings located adjacent to pond or reservoir --.  
i.e. summer homes etc.
7. Dimensions of Dam: Length 1600', Max. Height 71'.  
Slopes: Upstream Face 3/1 earth, stone faced.  
Downstream Face 3/1 earth.  
Width across top 15'.
8. Classification of Dam by Material:  
Earth  Conc. Masonry . Stone Masonry .  
Timber . Rockfill . Other .
9. A. Description of present land usage downstream of dam: 50% rural; 50% urban.  
B. Is there a storage area or flood plain downstream of dam which could accommodate the impoundment in the event of a complete dam failure  
Yes ; No

LIST OF AVAILABLE DOCUMENTS  
CLEVELAND BROOK RESERVOIR DAM

<u>DOCUMENT</u>	<u>LOCATION</u>
1. Original Cleveland Brook Reservoir Dam Construction Drawings (38 sheets) and Specifications, May 1948.	Metcalf & Eddy Engineers 50 Staniford Street, Boston, MA 02114 And City of Pittsfield, City Hall 70 Alden Street, Pittsfield, MA 01201
2. Drawings (5 sheets) for the Alterations to Cleveland Brook Reservoir Dam, January 1963	Metcalf & Eddy Engineers 50 Staniford Street, Boston, MA 02114 And City of Pittsfield, City Hall 70 Alden Street, Pittsfield, MA 01201
3. Report on Seepage at Cleveland Brook Reservoir Dam, December 1976	Metcalf & Eddy Engineers 50 Staniford Street, Boston, MA 02114 And City of Pittsfield, City Hall 70 Alden Street, Pittsfield, MA 01201

1973 REPORT ON SEEPAGE EXCERPTS

<u>DESCRIPTION</u>	<u>Page No.</u>
Reference letter dated July 28, 1976	B-34
Plan of Boring Logs	B-35
Results of Insitu Falling Head Permeability Tests	B-36
Piezometers - Location and Water Level Measurements	B-37
Boring Logs	B-38 to B-50

## APPENDIX B

### LIST OF AVAILABLE DOCUMENTS AND PRIOR INSPECTION REPORTS

#### Page No.

#### DOCUMENTS

List of Available Documents	B-1
Description of Dam (by Mass. Div. of Waterways)	B-2 to B-5

#### PRIOR INSPECTION REPORTS

<u>DATE</u>	<u>BY</u>	<u>Page No.</u>
August 12, 1966	County of Berkshire, Mass.	B-6
June 11, 1971	Mass. Div. of Waterways	B-7
September 28, 1972	Mass. Div. of Waterways	B-8 to B-10
January 29, 1974	Mass. Div. of Waterways	B-11 to B-13
November 5, 1975	Mass. Div. of Waterways (Supplementary Report to January 29, 1974)	B-14

#### DESIGN AND CONSTRUCTION DATA

<u>DATE</u>	<u>BY</u>	<u>Page No.</u>
June 9, 1948	Metcalf & Eddy, Engineers	B-15
February 10, 1949	Metcalf & Eddy, Engineers	B-16
January 7, 1963	Metcalf & Eddy, Engineers	B-17
January 14, 1963	Metcalf & Eddy, Engineers	B-19

#### DRAWINGS

<u>No.</u>	<u>TITLE</u>	<u>Page No.</u>
1	Main Dam-West Section Plan	B-21
2	Main Dam-East Section Plan	B-22
3	Dam and Dike, Typical Sections	B-23
4	30" Drain Profile & Intake Details	B-24
5	30" Supply Main Profile & Details	B-25
6	Gate Structure Mechanism Details	B-26
7	Boring Data	B-27
8	Boring Data	B-28
9	Boring Data	B-29
10	Boring Data	B-30
11	Dam-Plan & Sections, Dike A, B & C - Sections	B-31
12	Spillway - Plan & Sections	B-32
13	Dike A - Plan & Profile, Collapsible Flashboards Details & Sections	B-33

VISUAL INSPECTION CHECK LIST  
NATIONAL DAM INSPECTION PROGRAM

DAM: CLEVELAND BROOK RESERVOIR DAM

DATE: 1 MAY 1979

SPECIAL STRUCTURE:DRAINAGE OUTLET STRUCTURE

BY: R. WOOD

CHECK LIST	CONDITION
1. Outlet structure	<p>1.</p> <ul style="list-style-type: none"><li>a. Flap valve rusted and some debris present may prevent opening.</li><li>b. Flow (slight) out of drain pipe in right wall.</li><li>c. Flow along left toe of dam coming out from behind left wingwall.</li><li>d. Flow coming out from behind right wing wall.</li><li>e. Right wing wall has deteriorated top and exposed front face - much efflorescence.</li><li>f. Moss at top of headwall.</li><li>g. Left wall &amp; energy dissipators in good condition (concrete).</li><li>h. Alge growth in channel between walls.</li><li>i. Channel D/S overgrown with marsh grass with some young trees. Branch debris present.</li></ul>

VISUAL INSPECTION CHECK LIST  
NATIONAL DAM INSPECTION PROGRAM

DAM: CLEVELAND BROOK RESERVOIR DAM

DATE: 1 MAY 1979

CONTROL TOWER AND SERVICE BRIDGE:

BY: R. WOOD

CHECK LIST	CONDITION
1. Control Tower a. Seepage or Efflorescence b. Rust or Stains c. Cracks d. Condition of Joints e. Spalls, Voids or Erosion f. Visible Reinforcement g. General Struct. Condition	1. a. Slight on inside of brick. b. None observed. c. None observed. d. None observed. e. None observed. f. None observed. g. Roof excellent, walls & floor good Water to bot of operational floor; substructure not visible.
2. Service Bridge Superstructure a. Bearings and Anchor Bolts b. Longitudinal Members c. Transverse Members d. Bracing e. Underside of Deck f. Deck g. Expansion Joints h. Drainage System i. Railings j. Paint	2. a. Very good. b. Very good. c. Not observable. d. Not observable. e. Not observable. f. Not observable. g. h. None i. Good. j. Good.
3. Service Bridge Abut. & Piers a. Bridge Seat b. Backwall c. Abut. Alignment d. Bridge Approach e. General Struct. Condition	3. a. Excellent. b. Excellent. c. Good. d. Approach low. e. Excellent.
4. Equipment	4. Intake valve (3) are well maintained and operational. 1 outlet valve maintained and operational chain fall operational - Support beam in excellent condition. 2 lifting U bolts in good condition.

L-108

## INSPECTION REPORT - DAMS AND RESERVOIRS

1. Location: Box/Town HINSDALE. Dam No. 1-2-132-4.  
 Name of Dam Cleveland Reservoir. Inspected by: RDJordan-PFFezzie.  
 Date of Inspection 1/29/74.
2. Owner/s: per: Assessors \_\_\_\_\_. Prev. Inspection X.  
 Reg. of Deeds \_\_\_\_\_. Pers. Contact \_\_\_\_\_.
- |    |                      |                  |                       |                 |
|----|----------------------|------------------|-----------------------|-----------------|
| 1. | <u>Name</u>          | <u>City Hall</u> | <u>Pittsfield</u>     | <u>499-1100</u> |
|    | <u>St. &amp; No.</u> | <u>City/Town</u> | <u>State Tel. No.</u> |                 |
- |    |             |                      |                  |                       |
|----|-------------|----------------------|------------------|-----------------------|
| 2. | <u>Name</u> | <u>St. &amp; No.</u> | <u>City/Town</u> | <u>State Tel. No.</u> |
|----|-------------|----------------------|------------------|-----------------------|
- |    |             |                      |                  |                       |
|----|-------------|----------------------|------------------|-----------------------|
| 3. | <u>Name</u> | <u>St. &amp; No.</u> | <u>City/Town</u> | <u>State Tel. No.</u> |
|----|-------------|----------------------|------------------|-----------------------|
3. Caretaker [if any] c.g. superintendent, plant manager, appointed by absentee owner, appointed by multi owners.  
Louis Newbill City Hall Pittsfield, MA 499-1100  
Name St. & No. City/Town State Tel. No.
4. No. of Pictures taken 4.
5. Degree of Hazard: [if dam should fail completely]\*  
 1. Minor \_\_\_\_\_. 2. Moderate \_\_\_\_\_.  
 3. Severe \_\_\_\_\_. 4. Disastrous X.

\*This rating may change as land use changes [future development]

6. Outlet Control: Automatic \_\_\_\_\_. Manual X.  
 Operative X yes \_\_\_\_\_ no \_\_\_\_\_.
- Comments: \_\_\_\_\_  
 \_\_\_\_\_

upstream face of Dam: Condition:

1. Good X. 2. Minor Repairs \_\_\_\_\_.  
 3. Major Repairs \_\_\_\_\_. 4. Urgent Repairs \_\_\_\_\_.

Comments: \_\_\_\_\_  
 \_\_\_\_\_

L-102 A

- 2 -

DAM NO. 1-2-132-4

8. Downstream Face of Dam: Condition: 1. Good  . 2. Minor Repairs \_\_\_\_\_.  
3. Major Repairs \_\_\_\_\_. 4. Urgent Repairs \_\_\_\_\_.

Comments: \_\_\_\_\_

9. Emergency Spillway: Condition: 1. Good  . 2. Minor Repairs \_\_\_\_\_.  
3. Major Repairs \_\_\_\_\_. 4. Urgent Repairs \_\_\_\_\_.

Comments: \_\_\_\_\_

10. Water level @ time of inspection: 7 ft. above \_\_\_\_\_. below  \_\_\_\_\_.  
top of dam \_\_\_\_\_.  
principal spillway  \_\_\_\_\_.  
other \_\_\_\_\_.

11. Summary of Deficiencies Noted:

- Growth [Trees and Brush] on Embankment  \_\_\_\_\_.  
Animal Burrows and Nesting \_\_\_\_\_.  
Damage to slopes or top of dam \_\_\_\_\_.  
Cracked or Damaged Masonry \_\_\_\_\_.  
Evidence of Slippage \_\_\_\_\_.  
Evidence of Piping \_\_\_\_\_.  
Erosion \_\_\_\_\_.  
Leaks \_\_\_\_\_.  
Trash and/or debris impeding flow \_\_\_\_\_.  
Clogged or blocked spillway \_\_\_\_\_.  
Other \_\_\_\_\_.

## 12. Remarks &amp; Recommendations: [Fully Explain]

This dam is well maintained and in very good condition. The concrete spillway is in good shape; no cracks or spalling was noted. The flashboards are in place, and appear to be sound.

There is some widely scattered brush growing through the upstream rock slope. It would be a very minor task to remove this growth. A fairly heavy growth of brush covers the lower downstream slope and toe. The Pittsfield Water Department has informed me that this will be removed during the summer of 1974. The toe of the dam is dry and stable. No wet or spongy areas were found.

In my opinion the dam is safe.

The description of this structure was submitted in 1972. There are no changes to be noted.

For location see Topo Sheet 5-B.

## 13. Overall Condition:

1. Safe
2. Minor repairs needed \_\_\_\_\_
3. Conditionally safe - major repairs needed \_\_\_\_\_
4. Unsafe \_\_\_\_\_
5. Reservoir impoundment no longer exists [explain].  
Recommend removal from inspection list \_\_\_\_\_

## 12. Remarks &amp; Recommendations: (Fully Explain) Prev. Insp. date 1-29-74

## SUPPLEMENTARY REPORT-CLEVELAND RESERVOIR DAM HINSDALE, MASS.

On Wednesday, November 5, 1975, I inspected the downstream slope of the dam to investigate reports of heavy seepage at the right abutment. Inspection of the abutment area verified the reports. Approximately five feet above the berm, an area of seepage exists that was observed in 1974. Free water (approx. 2 gpm) was flowing from the center of the spongy area. The flow was clear, no fines were being carried away, however, evidence of previous soil displacement was noted. Within a radius of three feet of the outfall the slope was very unstable. I could penetrate the slope 2' - 3' with a 1" sapling with very little effort.

Since the leak and seepage was not noted in the 1971, 72, and 74 Dept. inspection reports, I researched the County Engineer's records. No mention of this condition was contained in any report dating back to the construction of the dam.

The Pittsfield Water Dept. was notified and advised to take appropriate action. An engineering firm retained by the City, has been investigating the condition for several weeks.

Although the leak is probably nothing more than a spring originating at old ground adjacent to the abutment, the size and location of the structure warrant a full investigation.

I will forward to your office all future information I receive concerning this matter.

## 13. Overall Condition:

1. Safe \_\_\_\_\_.
2. Minor repairs needed \_\_\_\_\_.
3. Conditionally safe - major repairs needed \_\_\_\_\_.
4. Unsafe \_\_\_\_\_.
5. Reservoir impoundment no longer exists (explain)  
Recommend removal from inspection list \_\_\_\_\_.

METCALF & EDDY  
Engineers  
Boston, Mass.

June 9, 1948  
NC/d

Pittsfield, Mass.  
Cleveland Brook Water Supply  
Reservoir and Diversion Works  
Design Data

Reservoir

Capacity	1500 million gallons
Surface Area	145 acres
Safe Yield	8 million gallons per day
Design Capacity of Supply Main from Reservoir	13.5 "

Dam

Length	1600 feet
Maximum Height	66 "
" Width	530 "
Freeboard - Main Dam	7 "
Dike	6 "
Water Surface	El. 1430
30" Drain Outlet	El. 1371
30" Supply Main Outlet	El. 1385

Spillway

Crest Length	80 feet
" Elevation	1430
Normal water level overflow	1429
Freeboard	5 feet
Design Depth	2.5 "
Design Flood Peak (equivalent to 980 cfs./sq.mi. plus 450 cfs. from diversion conduit)	2000 cubic feet per second
Design Discharge Peak	900 cubic feet per second

Diversion Works

Conduit Capacity	430 cubic feet per second
Cady Brook Diversion	
Drainage Area	3.6 square miles
Overflow Spillway Length	60 feet
Capacity of Spillway	2100 cubic feet per second 580 cfs./sq.mi.
East Branch Diversion	
Drainage Area	7.4 square miles
Overflow Spillway Length	70 feet
Capacity of Spillway	2800 cubic feet per second 380 cfs./sq.mi.

METCALF & EDDY  
ENGINEERS

STATLER BUILDING  
BOSTON 16, MASS.

FRANK A. MARSTON  
JOHN P. WENTWORTH  
HARRISON P. EDDY, JR.  
ARTHUR L. SHAW  
E. SHERMAN CHASE  
FRANK L. FLOOD

ALMON T. FALES  
CONSULTANT

FILE

J-Pittsfield  
Cleveland

INVESTIGATIONS AND RESEARCH  
PLANS AND SPECIFICATIONS  
SUPERVISION OF CONSTRUCTION  
SUPERVISION OF OPERATION  
MANAGEMENT VALUATIONS  
LABORATORY FOR CHEMICAL  
AND BIOLOGICAL ANALYSES

CABLE ADDRESS—"METED—BOSTON"

February 10, 1949

Mr. Harry W. Heaphy  
County Engineer  
Berkshire County Court House  
Pittsfield, Massachusetts

Dear Mr. Heaphy:

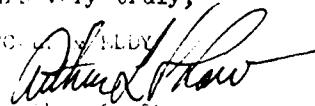
In order to keep you posted on the progress of the construction of Cleveland Brook dam in Hinsdale, there are two contemplated changes from the Contract Drawings which we believe you will be interested to know about.

A pervious formation of sand and gravel encountered under the upstream cutoff west of the brook has made it seem advisable to deepen the cutoff excavation to a depth of some 20 ft. below the brook level for a short distance west of the brook. It is expected that the work on this cutoff will proceed as soon as weather is favorable. In the west cutout, the contractor has elected to use open cut excavation in lieu of the sheeted trench contemplated by the Contract drawings, and this will be carried somewhat deeper than originally planned to reach satisfactory impervious material.

It is anticipated that when weather conditions are favorable you will visit the job and our resident engineer will be glad to discuss all phases of the work with you.

Yours very truly,

METCALF & EDDY

By-   
Arthur L. Shaw

NC/p

e/c to Mr. Whittelsey  
Mr. Cannon

**METCALF & EDDY**  
ENGINEERS

STAYER BUILDING  
BOSTON 10 - MASSACHUSETTS  
DRAFTS • PLANS • REPORTS

January 7, 1963

J - 5973

Mr. John Bradford  
Chief Waterways Engineer  
Division of Waterways  
Mass. Dept. of Public Works  
100 Harrison Street  
Boston, Massachusetts

Dear Mr. Bradford:

We have been engaged by our client, the City of Pittsfield, Massachusetts, to prepare plans and specifications for raising the height of the City's Cleveland Brook water supply dam. The question is whether this project would require the approval of the Division of Waterways. We shall, of course, submit final plans and specifications to the Berkshire County Commissioners for approval.

The dam was constructed in 1949 on Cleveland Brook in the Town of Mansfield about 2-1/2 miles north of Dalton. The dam consists of an earth embankment and one dike across Cleveland Brook. A low concrete spillway is located at a saddle in the easterly side of the reservoir basin about one-half mile southeasterly of the dam. The earth embankment has a maximum height of 66 ft. and a top width of 40 ft. The spillway is 1 ft. high and 80 ft. long with a depth of 5 ft. Stop logs 2 ft. high are on the crest of the spillway. The difference in elevation between the top of the dam and the crest of the spillway is 7 ft.

The dike has been designed as a fuse plug to permit overflow should water level in the reservoir approach within one foot of the top of the dam. The tributary drainage area of the dam is 1.5 square miles.

INVESTIGATIONS • REPORTS • DESIGNS • SUPERVISION OF CONSTRUCTION • SUPERVISION OF OPERATION  
MANAGEMENT • VALUATIONS • LABORATORIES • RESEARCH

APPENDIX B-17

John Bradford  
January 7, 1960

2

**METCALF & EDDY**

ENGINEERS

We plan to raise the top of the dam. A new concrete spillway crest will be constructed 5 ft. above the existing one. The new spillway section will be flanked by two earth dikes. One of these new dikes will be designed as an emergency overflow should the water in the reservoir approach within 2 ft. of the crest of the dam. The existing dike will be raised to the elevation of the new crest of the dam. The crest of the spillway will be provided with 2 ft. high flashboards. The center 30 ft. of these boards will be designed to collapse with water 0.5 ft. over the top of the boards.

Since we plan to advertise for bids in the very near future, it would be appreciated if the approval of the Division of Waterways of this project, if required, could be furnished us at the earliest possible date.

If you should require additional information, please contact us.

Very truly yours,

METCALF & EDDY

WES  
GOTTM

Walter Werry  
Project Engineer

INVESTIGATIONS • REPORTS • DESIGNS • SUPERVISION OF CONSTRUCTION • SUPERVISION OF OPERATION  
MANAGEMENT • VALUATIONS • LABORATORIES • RESEARCH

METCALF & EDDY

ENGINEERS

STANLEY BUILDING  
BOSTON 10 - MASSACHUSETTS  
TELEPHONE: TUTWELL 7-2121

January 14, 1963

PRINCIPAL DESIGN DATA  
FOR  
ALTERATIONS TO CLEVELAND BRICK DAM

Reservoir

Drainage area, sq. mi.	1.5
Area of water surface (Top of existing flashboards El. 1432) acres	137
Area of water surface (Top of new flashboards El. 1437) acres	160
Capacity (Below top of existing flashboards)	mil. gals 1461
Capacity (below top of new flashboards)	mil. gals 1704

Dam

El. top of dam (existing)	1437
El. top of dam (raised)	1442
Unraised height of dam, ft.	1445
Top width of dam (existing), ft.	40
Top width of dam (raised), ft.	17.5
Max. height of dam (existing), ft.	60
Max. height of dam (raised), ft.	71
Existing freeboard above flashboards (El. 1432), ft.	5
New freeboard above flashboards (El. 1437), ft.	5

Spillway

Length of spillway, ft.	80
El. top spillway crest (existing)	1430
El. top spillway crest (new)	1435
El. top flashboards (existing)	1432
El. top flashboards (new)	1437
El. top existing abutments	1435
El. top raised abutments	1441
Freeboard at abutments above top of flashboards (existing), ft.	3
Freeboard at abutments above top of flashboards (new), ft.	4

INVESTIGATIONS • REPORTS • DESIGN • SUPERVISION OF CONSTRUCTION • SUPERVISION OF OPERATION  
MANAGEMENT • VALUATIONS • LABORATORY • RESEARCH

**Spillway (cont'd)**

III. water surface at design flood (existing flashboards in place)	3439.3
III. water surface at design flood (new flashboards with center 30 ft. collapsed and remainder in place)	3439.7
Frontboard at design flood (existing flashboards in place), ft.	0.7
Frontboard at design flood (new flashboards with center 30 ft. collapsed and remainder in place) ft.	2.3
Design peak discharge at spillway, c.f.s.	900
Design flood peak inflow to reservoir, c.f.s.	2000

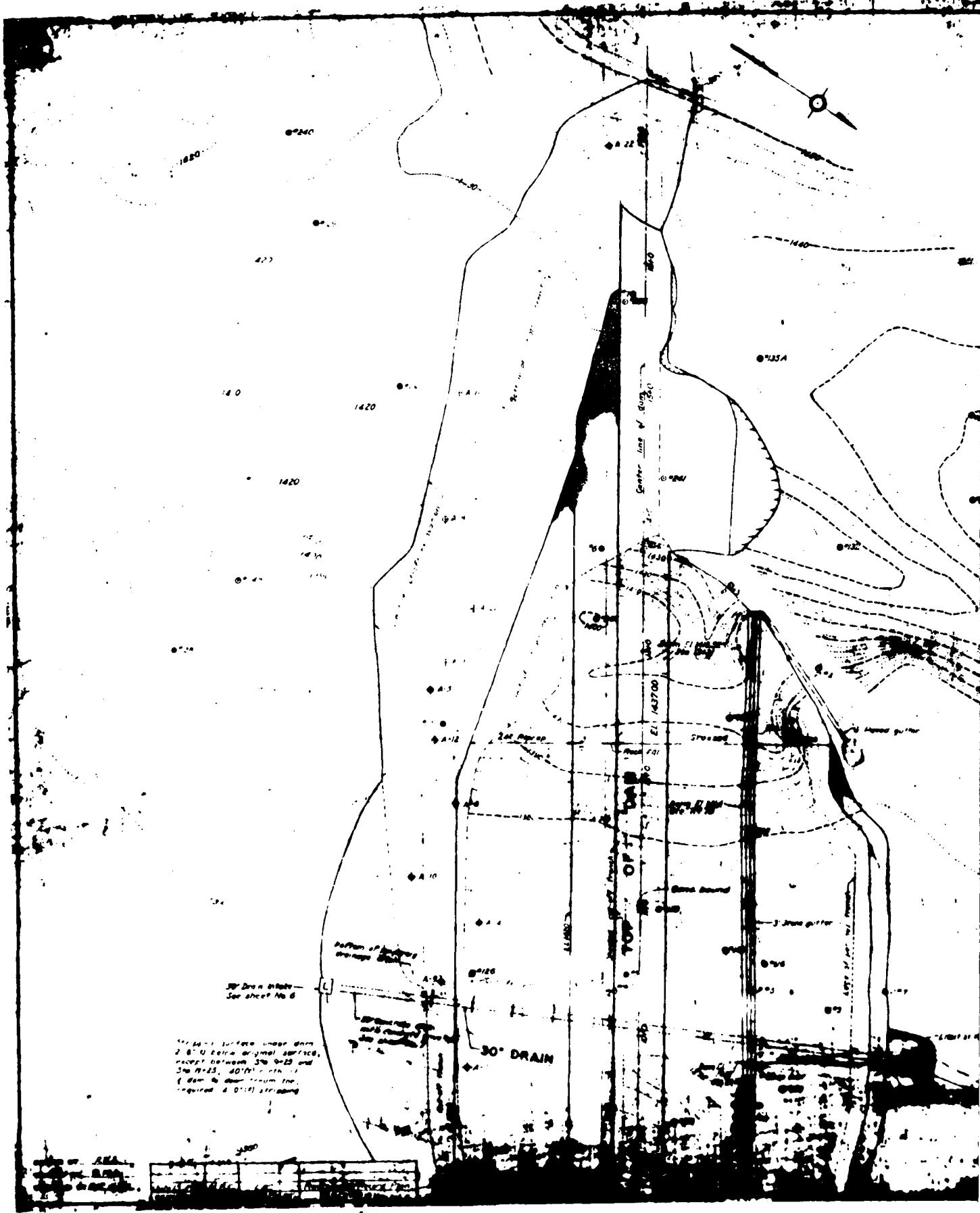
The design flood peak inflow to the reservoir is based on a run-off from the drainage area of 1800 c.f.s./sq. mi. or 1500 c.f.s. Added to this is the capacity of the diversion of approximately 300 c.f.s. from Oaky and Wadsworth Brooks making a peak inflow to the reservoir of 2200 c.f.s.

The design peak discharge at the spillway of 900 c.f.s. is a result of the peak inflow to the reservoir being modified by the storage capacity of the reservoir above the top of the flashboards.

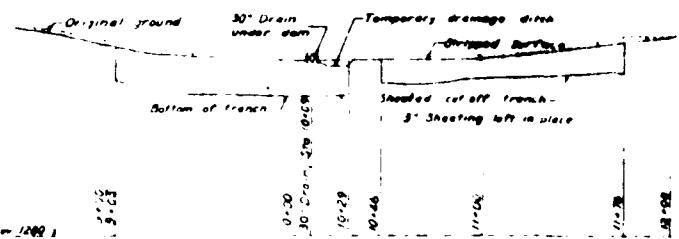
Discharge over the spillway was determined by the following formula:

$$Q = CL^{\frac{3}{2}}$$

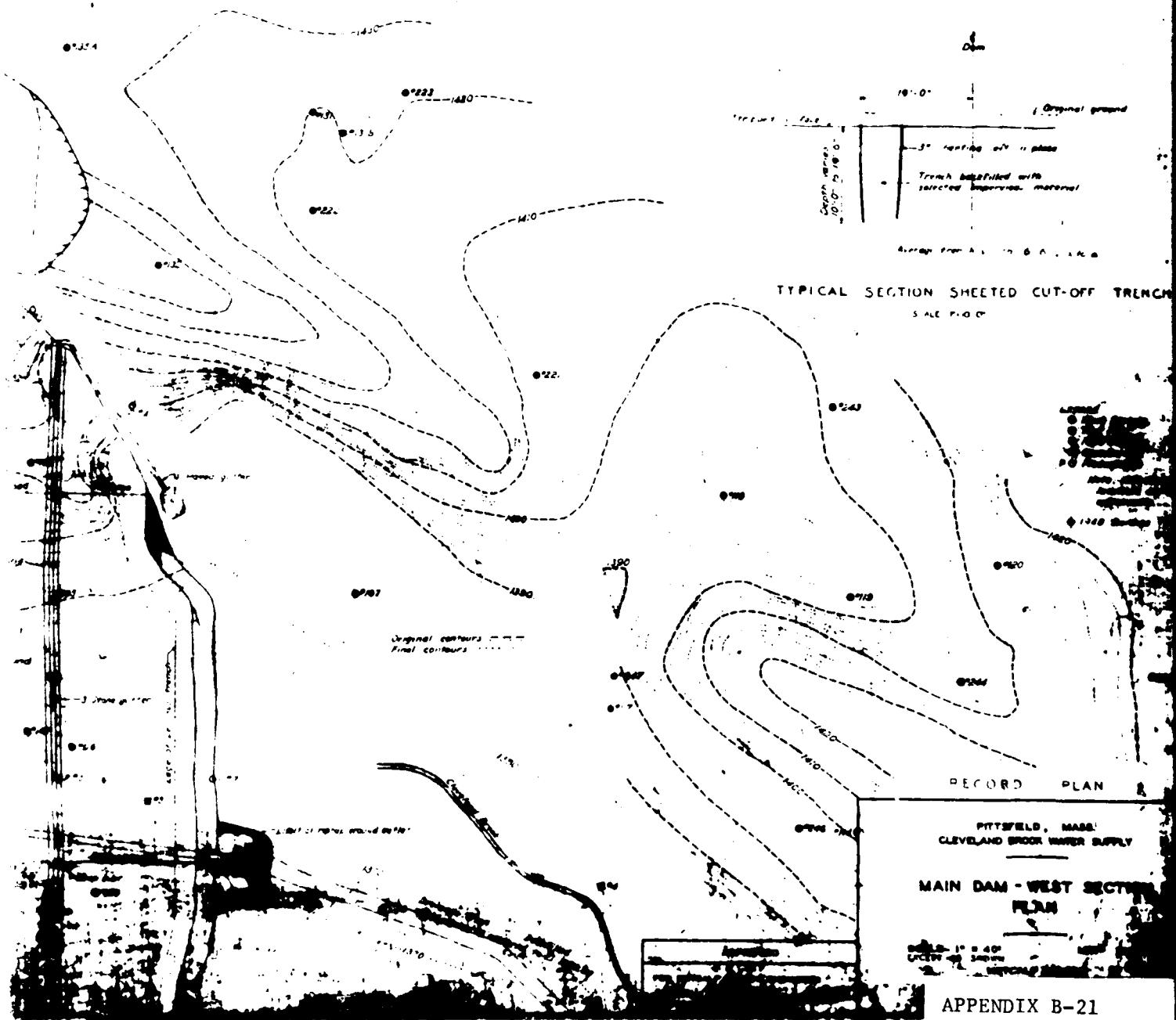
Where Q = Discharge over spillway, c.f.s.  
 C = Coefficient, 3.3 for Flashboards vertical, 2.7  
       for Flashboards horizontal  
 L = Length of weir section in feet  
 H = Head on weir in feet



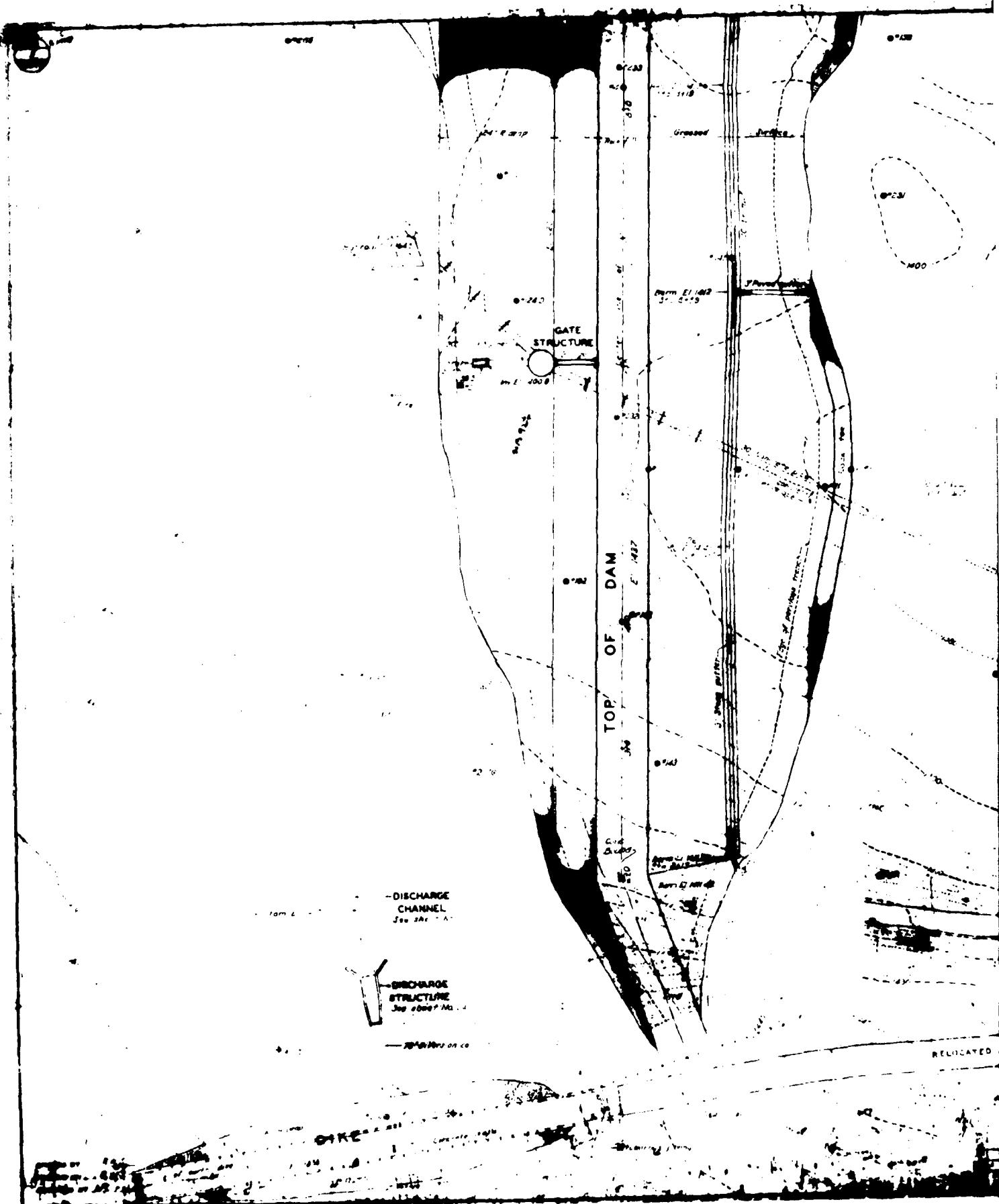
No. of deer 601037

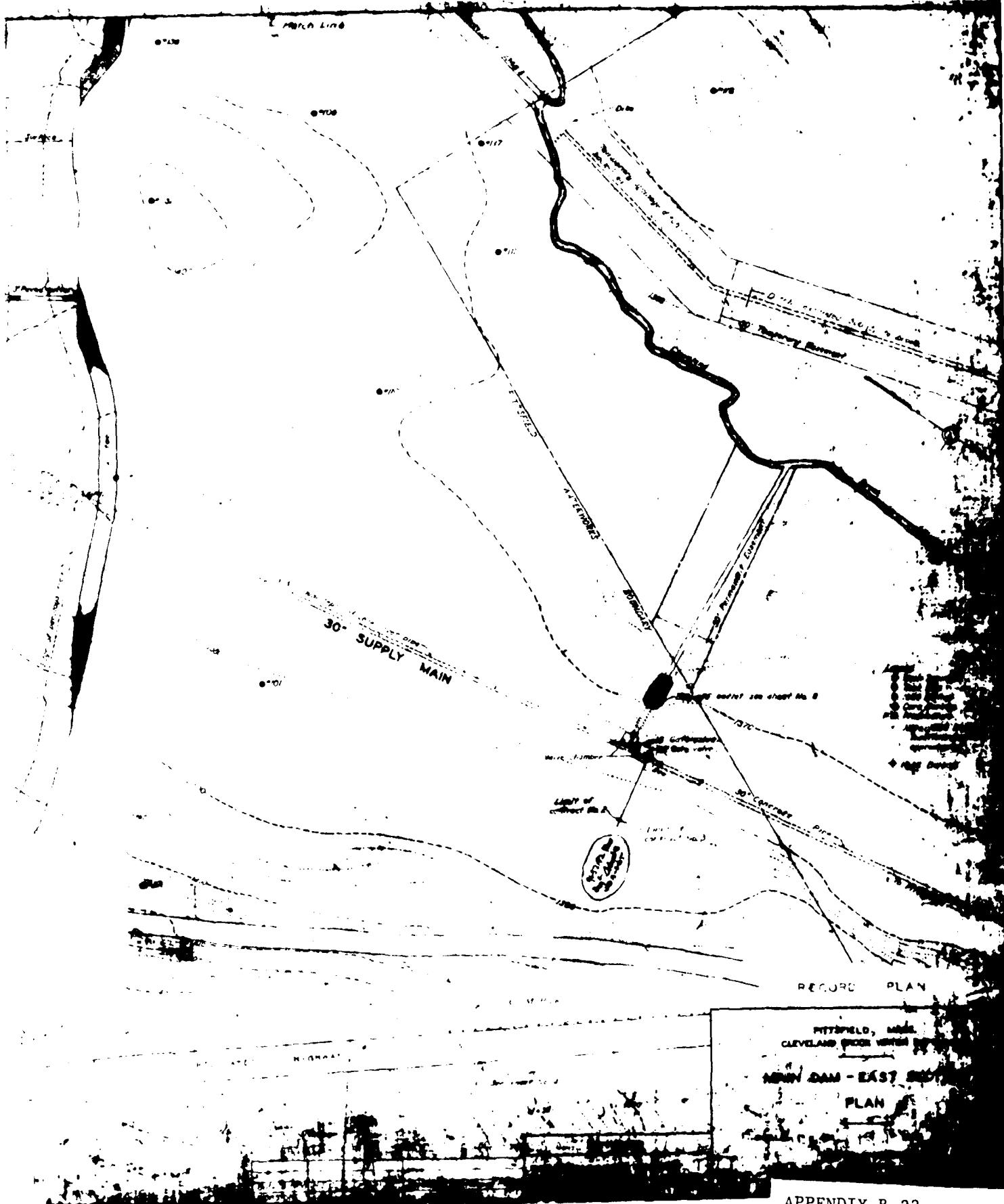


**PROFILE SHEETED CUT-OFF TRENCH**



## APPENDIX B-21

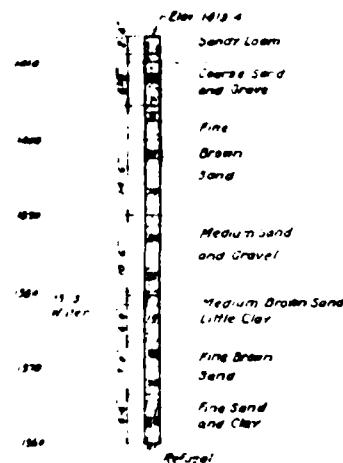




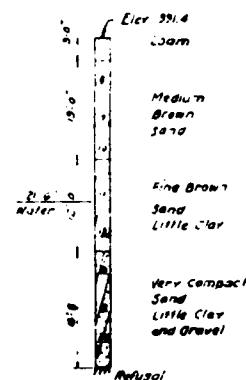
APPENDIX B-22



NO. 126



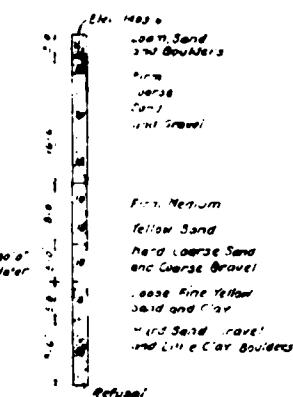
NO. 127



\$ Dam

Note:  
Indicates number 11  
to drive Sampling P  
unless otherwise in  
100 lb weight falling

NO. 106



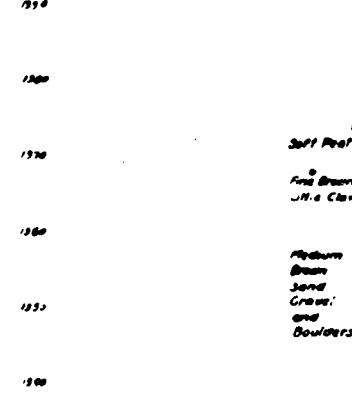
Note:  
All borings were made  
Concrete Pipe Co. are  
noted as wash bars  
November and Decem

Note:  
Loss of marsh water  
indicated by a  
indicates no water

Note:  
Test pits indicate for  
considerable stand  
leads to the concre  
shown on many be  
crossing striking re  
of rock.

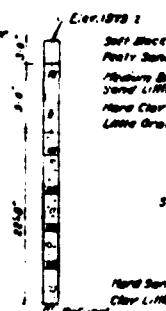
## BORINGS BETWEEN 990 FEET AND 110 FEET

NO. 126



1930 BORING

NO. 5



NO. 139



NO. 6



NO. 16



NO. 3



CORE BORING



NO. 1



NO. 2



NO. 4



NO. 5



NO. 6



NO. 7



NO. 8



NO. 9



NO. 10



NO. 11



NO. 12



NO. 13



NO. 14



NO. 15



NO. 16



NO. 17



NO. 18



NO. 19



NO. 20



NO. 21



NO. 22



NO. 23



NO. 24



NO. 25



NO. 26



NO. 27



NO. 28



NO. 29



NO. 30



NO. 31



NO. 32



NO. 33



NO. 34





410

Note  
Indicates number of blows required  
to drive sampling pipe one foot  
unless otherwise indicated using  
100-lb weight falling 30"

400

390

Note  
Loss of wash water in any sample  
indicated by a. Absence of #  
Indicates no water reported lost

380

## NO. 125

Elev. 378.1

3.6' water  
Loam and Boulders  
Coarse brown  
Sand and gravel  
Little Clay  
Fine Brown Sand  
Little Clay  
Decomposed Rock  
Refusal

## NO. 140

Elev. 378.7

2.6' water  
Loose fine yellow sand  
and gravel  
Loose fine yellow sand  
and gravel  
Little Clay  
Hard Sand  
Gravel and  
Boulders  
Loose yellow  
Sand  
Little Clay  
Very Sand  
Gravel and  
Clay  
Boulders  
Refusal

## NO. 104

Elev. 378.7

1.6' water  
Peat  
Loose fine yellow sand  
and gravel and Little Clay  
Firm Medium yellow  
Sand and Gravel  
Boulders  
Hard  
Sand  
Sand  
Gravel  
and Clay  
Refusal

## NO. 108

Elev. 378.6

1.6' water  
Soft Peat  
Hard Sand, Gravel  
and Boulders  
Loose Medium  
Yellow Sand  
and Gravel  
Firm Sand  
Gravel and  
Clay  
Hard Sand  
Gravel, Clay  
and  
Boulders  
Refusal  
Loam  
Sand  
Gravel  
and  
Boulders  
Coarse Brown  
Sand Gravel  
Little Clay  
Boulders and  
Refusal  
Fine Brown  
Sand  
Little Clay  
and Mica  
Refusal  
Medium Brown  
Sand Clay  
Gravel Boulders  
and Mica  
Refusal

## LOHE BORING

110.4'

## NO. 113

Elev. 378.0  
1.6' Soft Peat  
Light Brown Sand  
Loose Fine  
Yellow Sand  
Little Clay  
Boulders  
Loose Mica  
Little Clay  
Loose Fine  
Yellow Sand  
Little Clay  
Refusal

## 1930 BORING

## WASH AND CORE BORING

## NO. 133

NO. 4

Elev. 378.8

1.6' water  
Elev. 378.8  
Loam Sand  
Gravel and  
Boulders  
Coarse Sand  
and Gravel  
Little Clay  
Very Compact  
Sand and Gravel  
Little Clay  
Refusal

Hard Fine Sand  
and Boulders  
Some Gravel Little  
Clay and Boulders  
Coarse Sand  
Gravel  
and Boulders  
Boulder  
Medium Sand  
Coarse Gravel  
and Boulders

## NO. 138

## NO. 109

Elev. 378.6  
Loam Sand  
Hard 16 cm.  
Sand Gravel  
and Boulders  
Very Coarse  
Sand, Gravel  
and Boulders  
Hard Sand, Gravel  
Clay and Boulders  
Refusal

Elev. 377.1  
Loamy Sand  
and Shales  
Hard Sand  
Gravel and  
Boulders  
Refusal

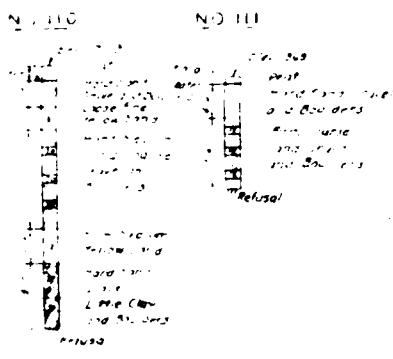
## NO. 137

Elev. 378.6  
Soft Peat  
Loose Fine Yellow  
Sand Little Clay  
Boulders  
Very Decomposed  
Sand Gravel  
Very Yellow Sand  
and Gravel  
Little Clay

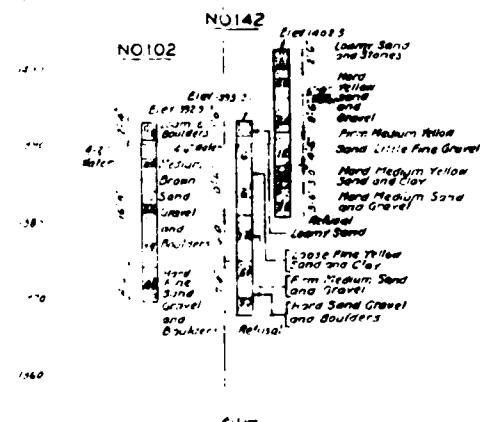
BORINGS BETWEEN 705 FEET AND 800 FEET WEST

**Note**  
All borings were made by the McNeil Concrete Probe and unless otherwise noted are wash borings, made in November and December 1947.

**Note**  
Test oils indicate formation containing considerable stone of varying sizes, which leads to the conclusion that refusal shown on many bottomings may be due to clogging the intake valve or small particles.

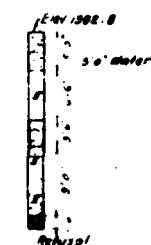


NO.143



میراث

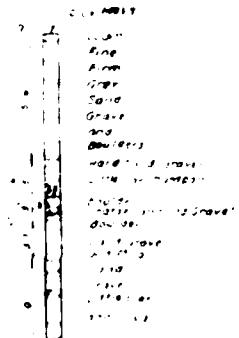
NO. 10



1930 SPRING

**WASH AND CORE BORING**

NC3A



11.16  
Indicates the number of blocks required to drive sampling pipe one foot, unless otherwise indicated.  $\frac{1}{2}$  lb. weight falling 30".

Note  
Loss of wash water in any stratum  
indicated by \* Absence of \*  
indicates no water reported lost

Note  
for location of cavings see Sheet  
No. 2 p. 236

PITTSFIELD, MASS  
CLEVELAND BROOK WATER SUPPLY

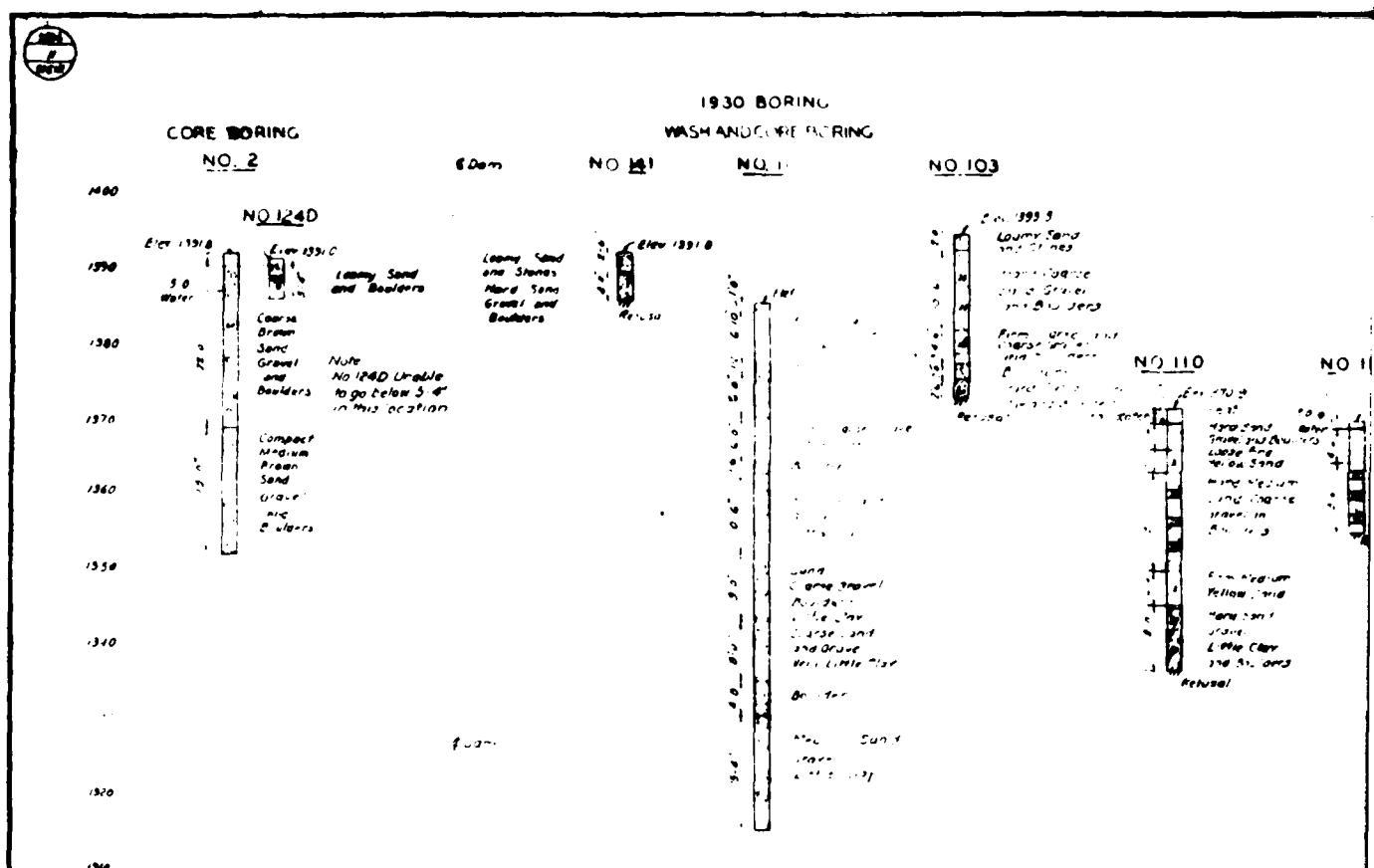
## **BORING DATA**

SCALE - AS SHOWN MAY 1948  
METCALF & EBBY  
ENGINEERS  
BOSTON, MASS.

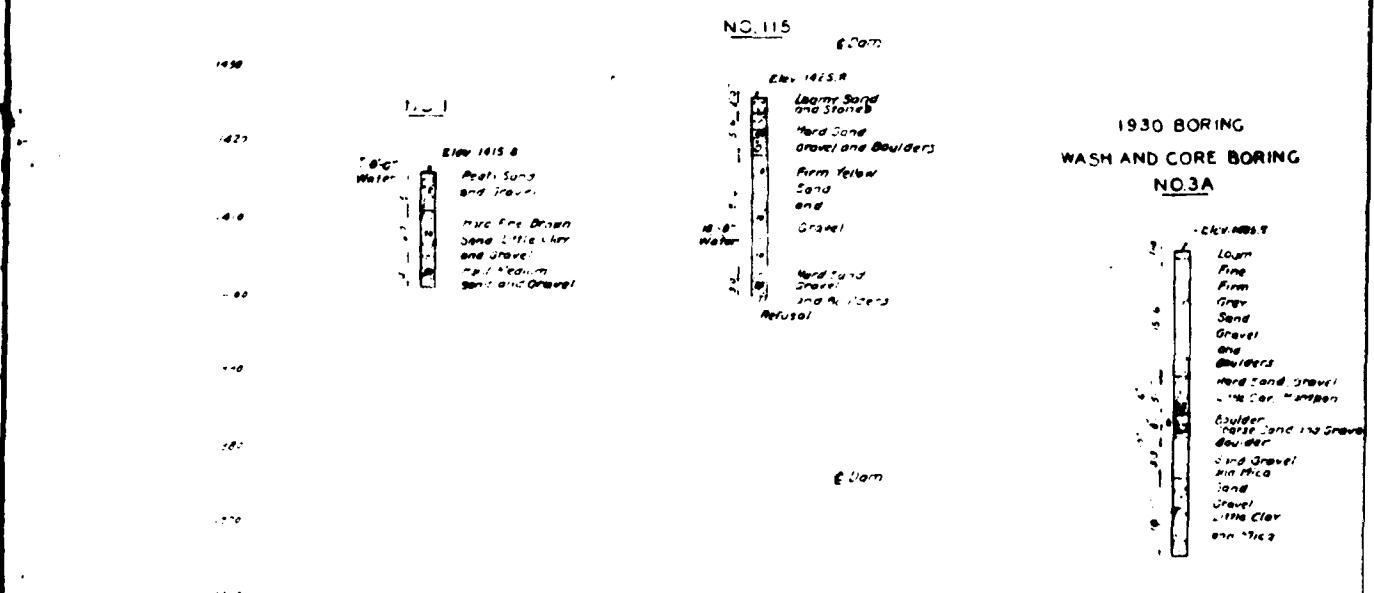
**APPROVED**

APPENDIX B-27

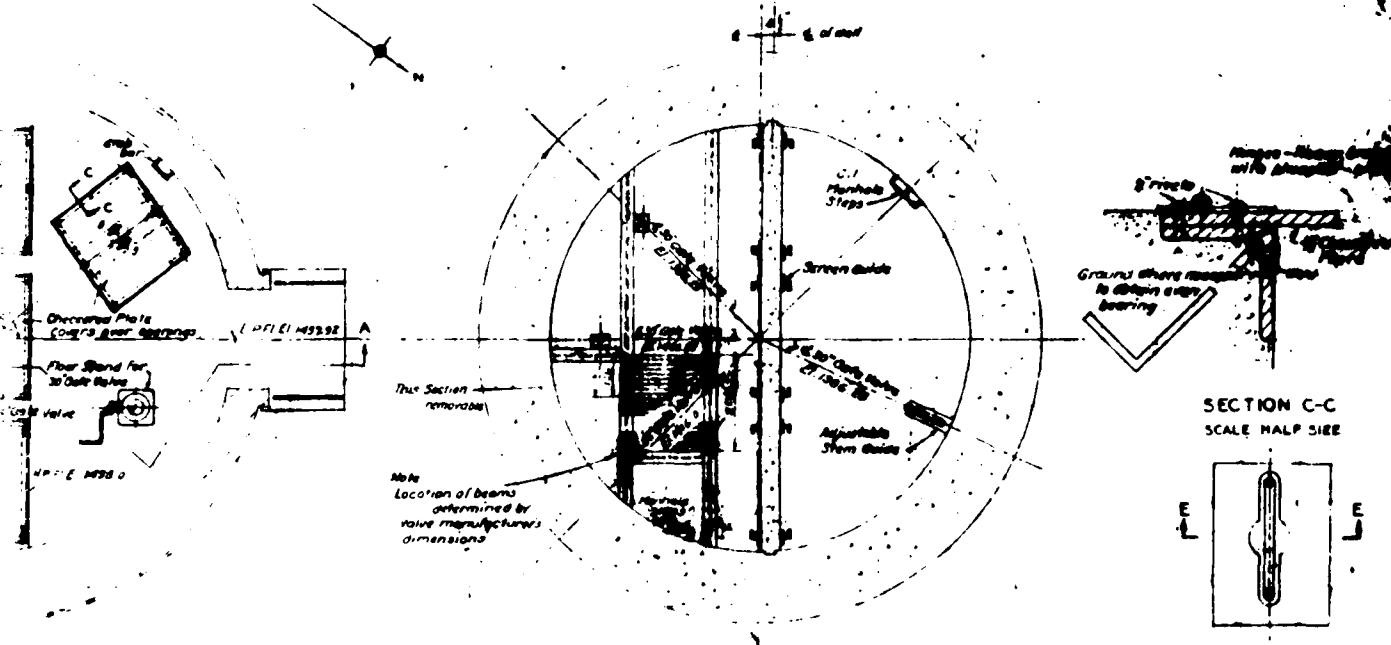
2



BORNS BETWEEN 310 FEET AND 490 FEET WEST 1 ROAD



BORINGS BETWEEN 55 FEET EAST AND 10 FEET WEST OF C ROAD

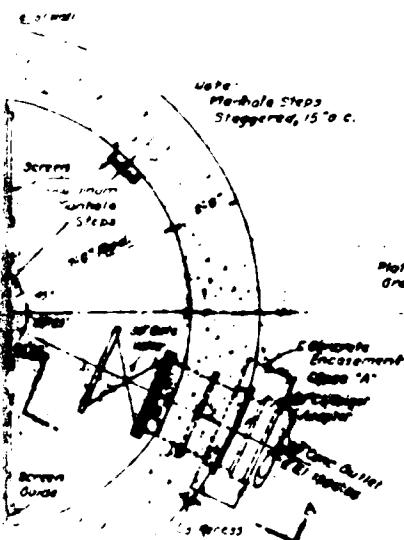


PLAN

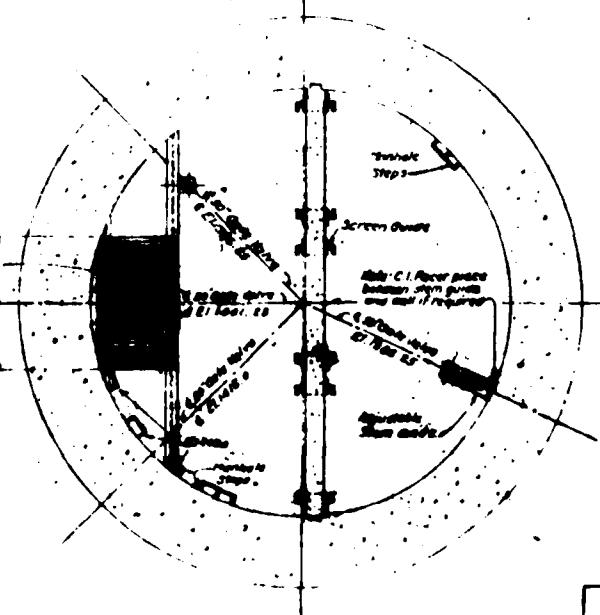
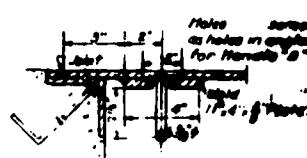
10'-0"

PLAN AT ELEVATION 1413.0

PLAN

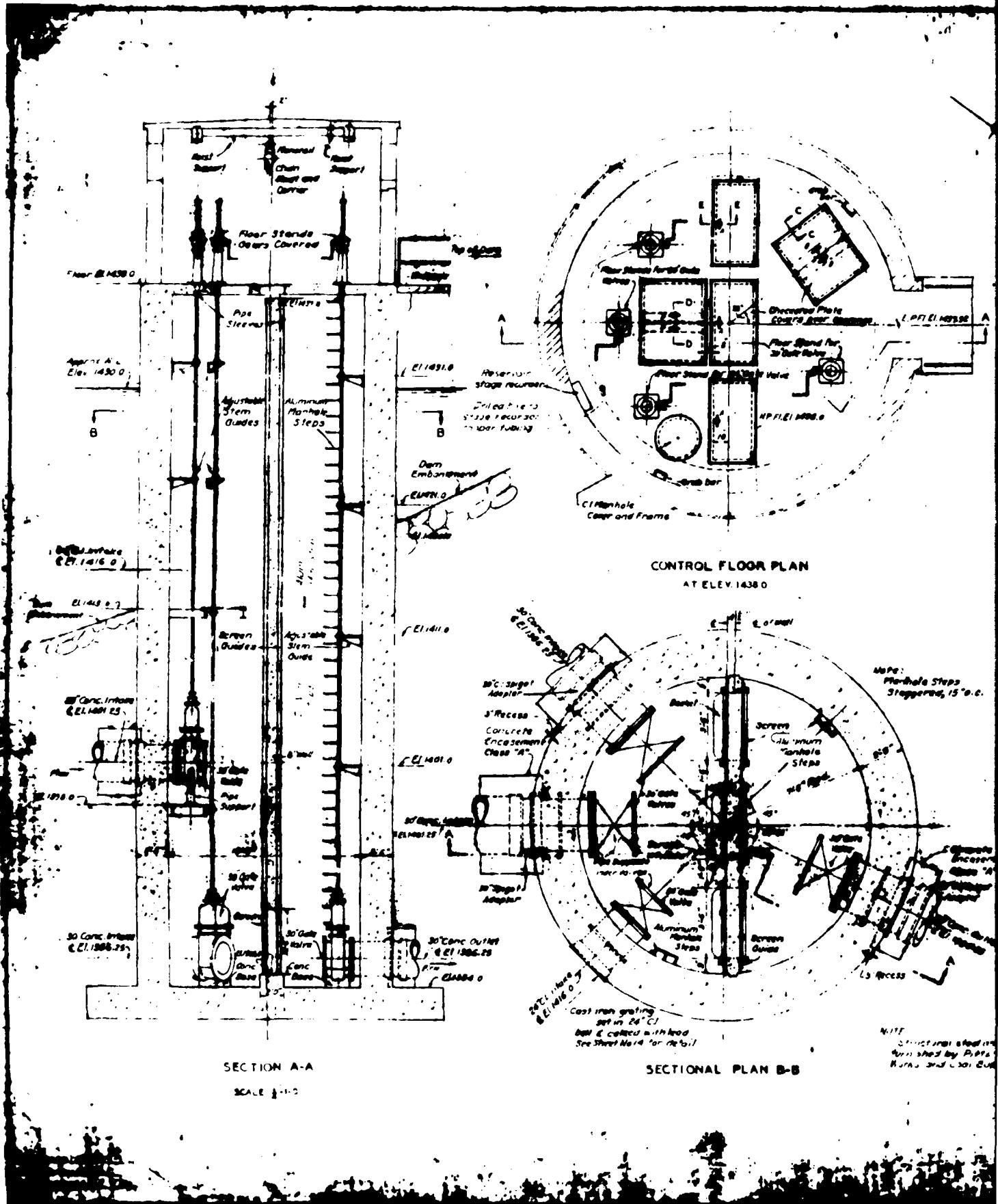


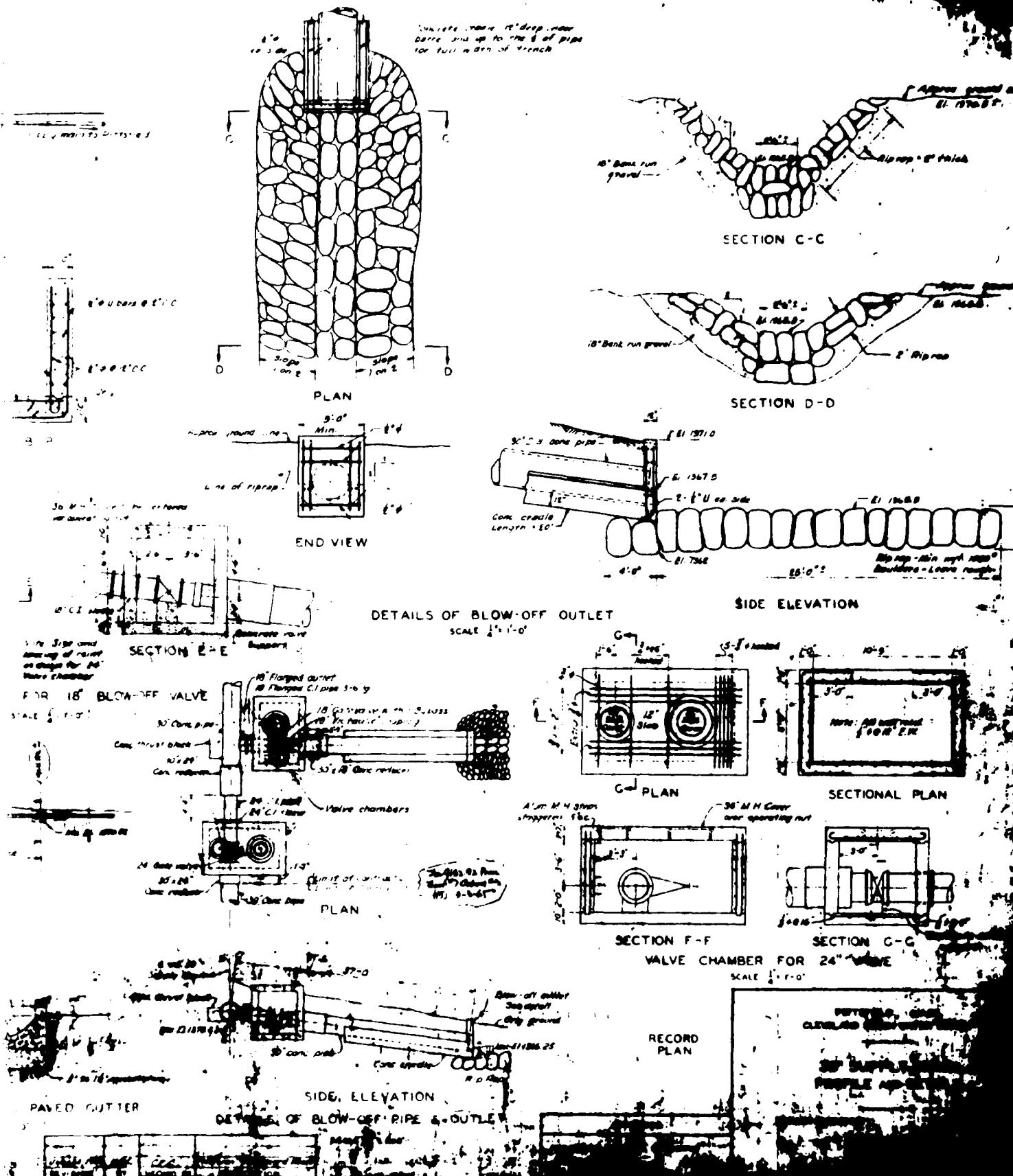
PLAN B-B

SECTION D-D  
HANDLE-BSECTION E-E  
HANDLE-A  
SCALE 3H-0

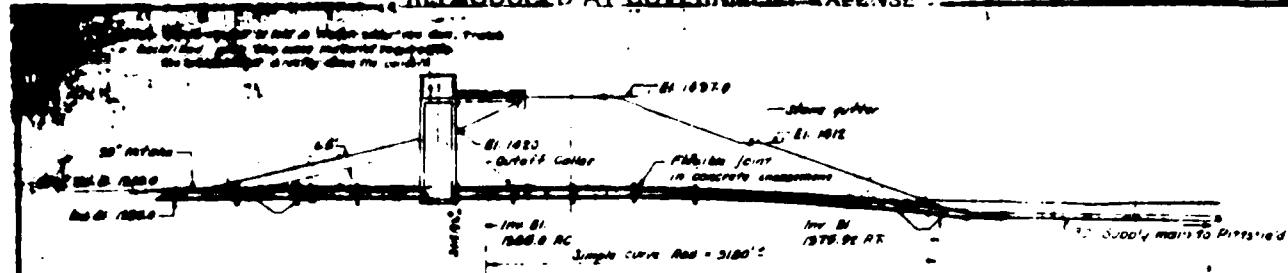
RECORD PLAN

PITTSFIELD, MASS.  
CLEVELAND BRIDGE WATER SUPPLYGATE STRUCTURE  
MECHANICAL DESIGN

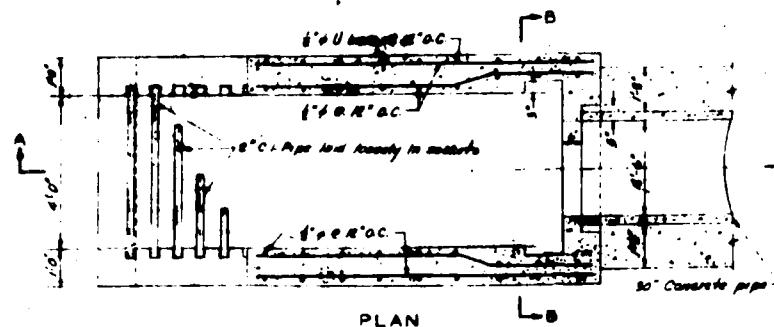




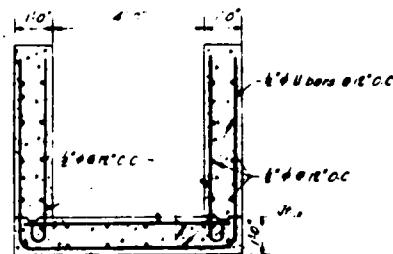
2



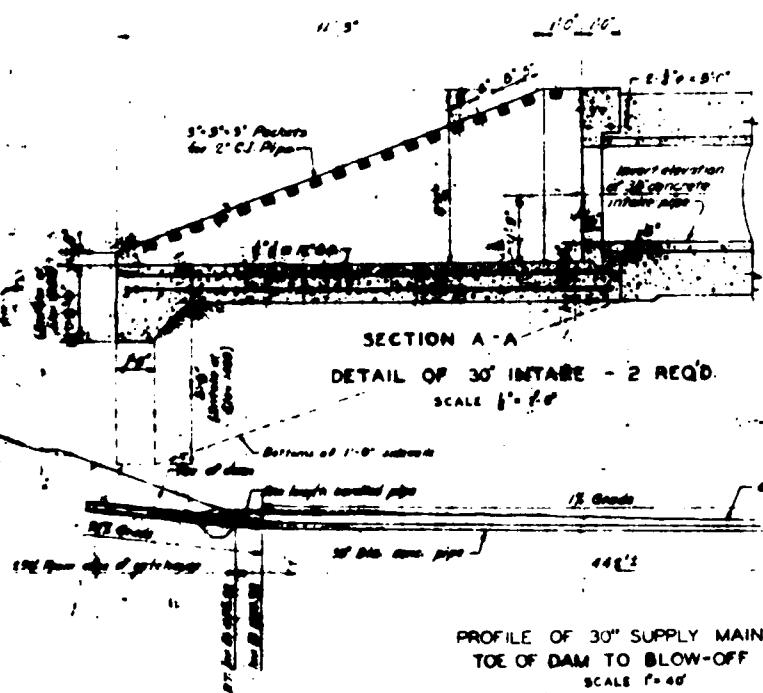
PROFILE ALONG E OF 30' INTAKE AND 30' CUTLET  
SCALE 1:48'



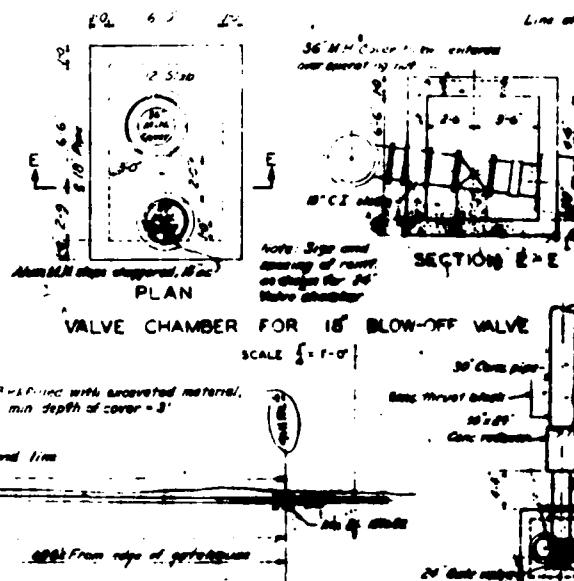
PLAN



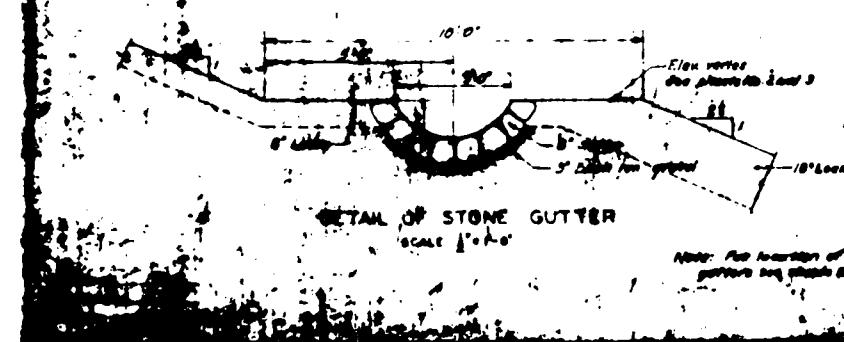
**SECTION B-B**



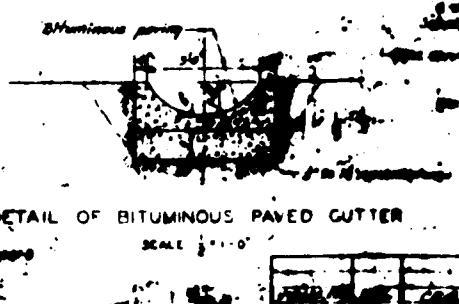
DETAIL OF 30' INSTARE - 2 REQ'D.  
SCALE 1'-0"



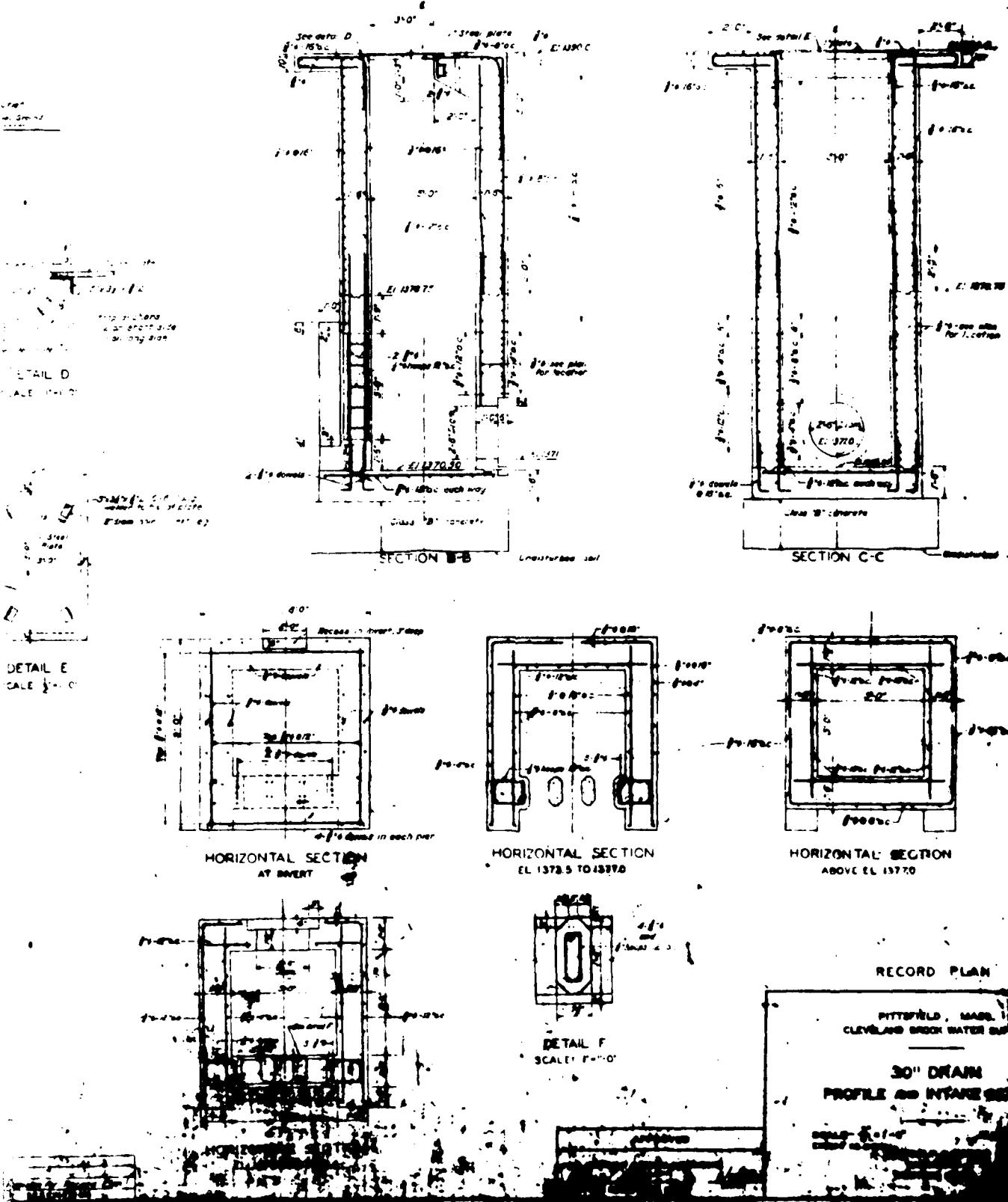
VALVE CHAMBER FOR 16" BLOW-OFF VALVE  
SCALE { = 1-0" }

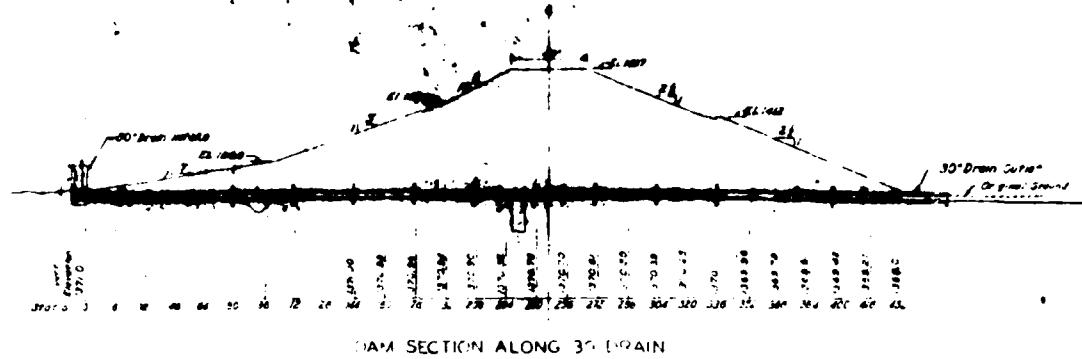


DETAIL OF STONE GUTTER  
Scale 1:100

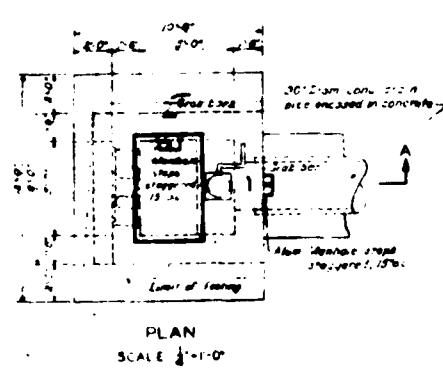


**DETAIL OF BITUMINOUS PAVED CUTTER**

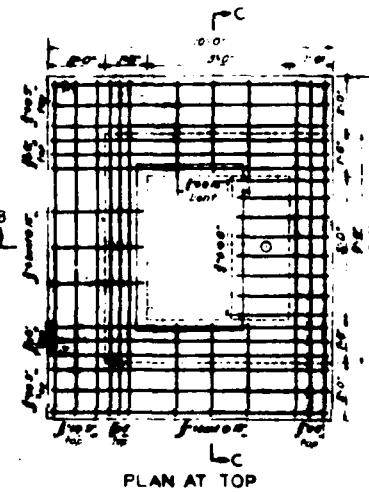




DAM SECTION ALONG 30° DRAIN  
SCALE 1'-0"

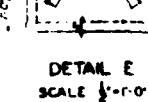


PLAN  
SCALE 1'-0"

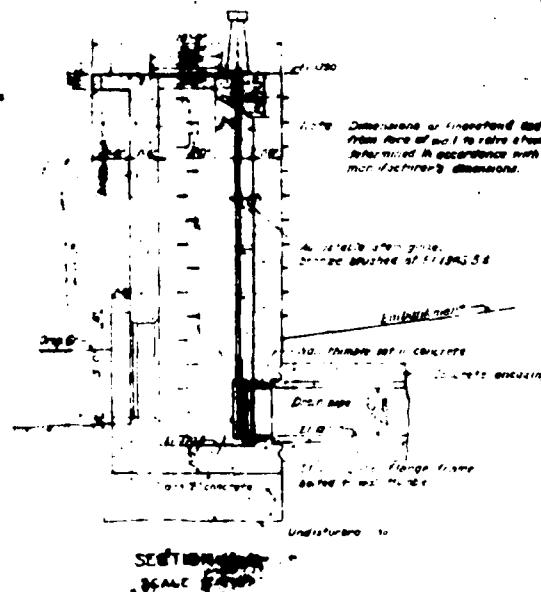


PLAN AT TOP

DETAIL D  
SCALE 1'-0"



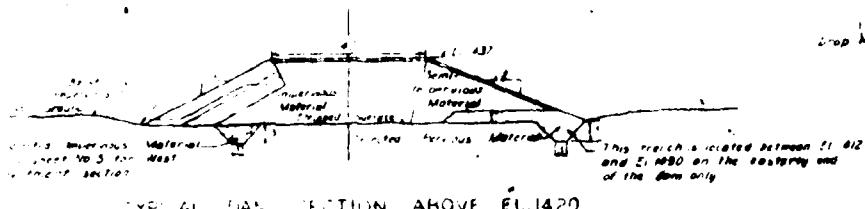
DETAIL E  
SCALE 1'-0"



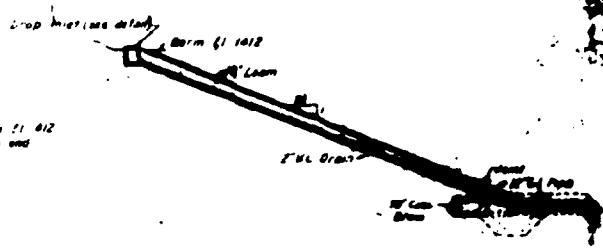
SECTION B-B  
SCALE 1'-0"

REPRODUCED AT GOVERNMENT EXPENSE  
BY THE GOVERNMENT OF CANADA  
1943

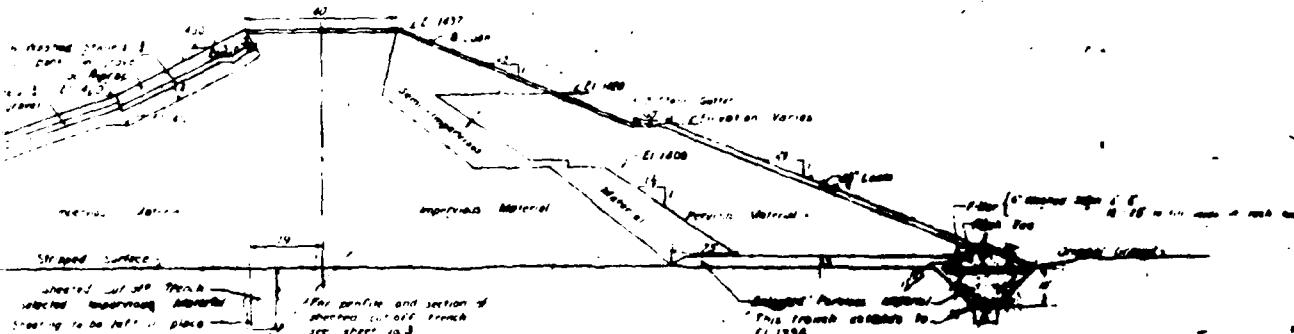
REPRODUCTION OF 12' DRAIN  
Details of 12' drain shown below  
Ditch 12' general  
foot thick around base  
passes through rock area



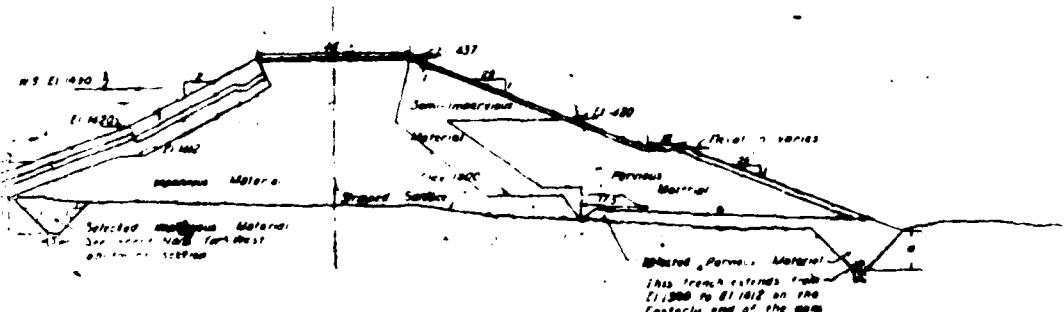
TYPICAL DAM SECTION ABOVE EL.1420



PROFILE OF 12' SURFACE DRAIN



TYPICAL DAM SECTION



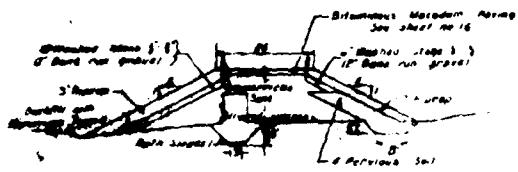
TYPICAL DAM SECTION ABOVE EL.1390

Water 31' - 12' drainage area indicated on Typical Dam Section

RECORD PLAN

PITTSFIELD, MASS.  
CLEVELAND SPRINGS WATER SUPPLY

DAM AND DRAINS  
TYPICAL SECTION



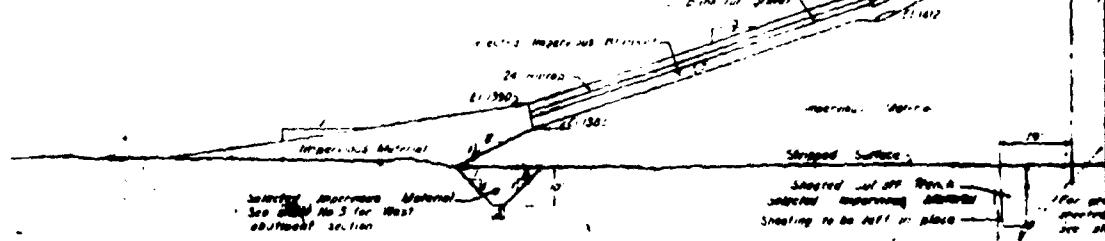
~~TRI~~AL ORKE SECTION NEAR PIPE LINE CROSSING



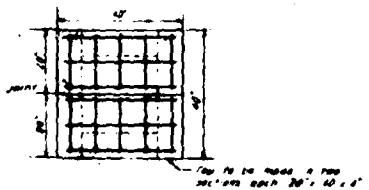
TYPICAL DAY SECTION



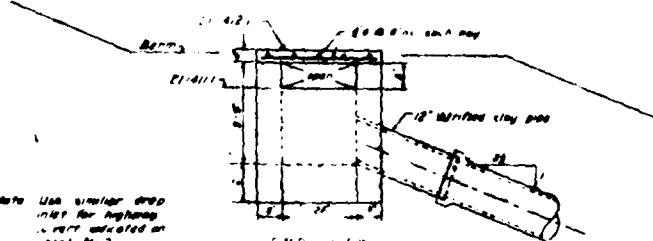
**TYPICAL SKE SECTION**



Typical Dam.



*P. S. N.*

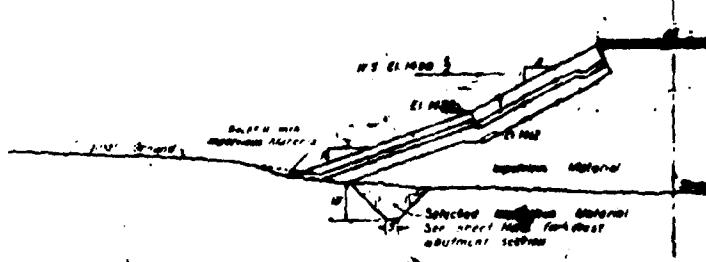


Map 90 Use similar drop  
inlet for Anglers  
- or - indicated on  
sheet No. 2

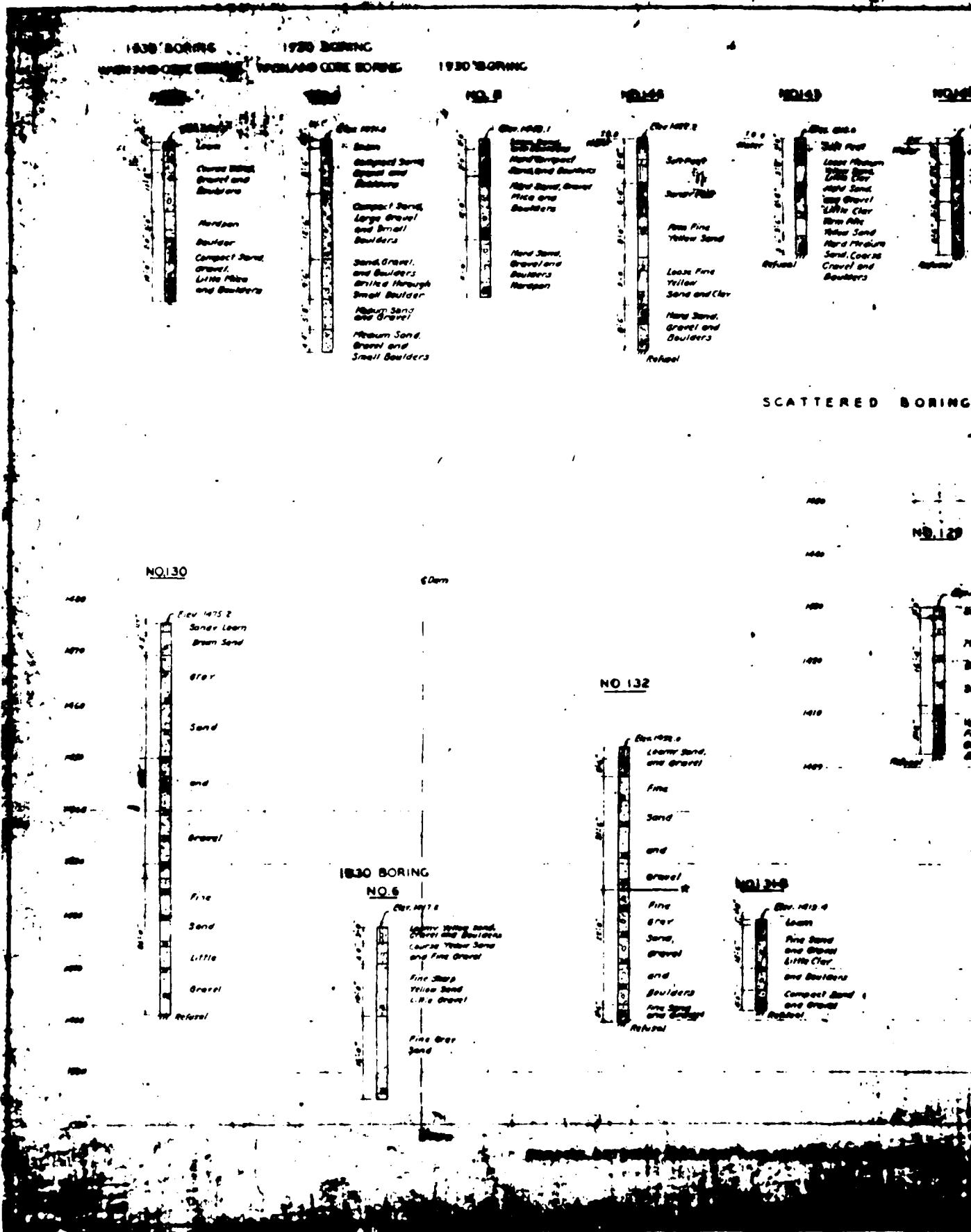
DROP IN ET

STA. 9 + 70

SCALE : 1 : 0'



TYPICAL DAM SECTION



## 1930 BORING

## 1930 BORING WASHAND CORE BORING

NO. 143

NO. 144

NO. 2

NO. 1

Dark brown  
Sand  
Clay  
Very Soft  
Very Clay  
Very Sand  
Very Clay  
Sand  
Gravel  
Clay  
Boulders

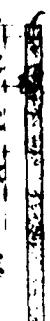


Dark brown  
Sand  
Clay  
Very Soft  
Very Clay  
Very Sand  
Gravel  
Clay  
Boulders

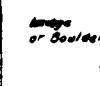
Dark brown  
Sand  
Clay  
Very Soft  
Very Clay  
Very Sand  
Gravel  
Clay  
Boulders



Dark brown  
Sand  
Clay  
Very Soft  
Very Clay  
Very Sand  
Gravel  
Clay  
Boulders



Dark brown  
Sand  
Clay  
Very Soft  
Very Clay  
Very Sand  
Gravel  
Clay  
Boulders



Note:  
Indication of water in 1930 boring  
in order to determine  
whether or not infiltration of  
100 ft. might be  
possible.

Note:  
All boring instruments by the German  
Company P. & C. Orlano under the  
name are wash borings, made in  
November and December 1940.

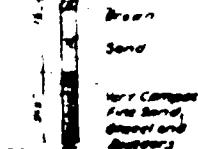
Note:  
Loss of wash water in 1930 boring  
indicated by a dashed line  
indicates no water appearance.

Note:  
Test pits indicate formation containing a  
considerable area of weathered rock, which  
leads to the depression that appears to  
show on most borings around due to  
caving striking relatively small areas  
of rock.

## ALTERED BORINGS-EAST OF ROAD

NO. 129

Dark brown  
Sand  
Clay  
Very Soft  
Very Clay  
Very Sand  
Gravel  
Clay  
Boulders

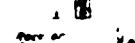


NO. 145

1930 BORING

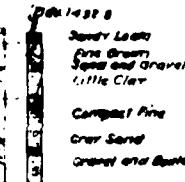
NO. 7

Dark brown  
Sand  
Clay  
Very Soft  
Very Clay  
Very Sand  
Gravel  
Clay  
Boulders



NO. 150

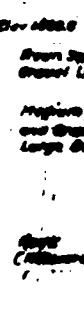
Dark brown  
Sand  
Clay  
Very Soft  
Very Clay  
Very Sand  
Gravel  
Clay  
Boulders



## CORE BORING

NO. 1

Dark brown  
Sand  
Clay  
Very Soft  
Very Clay  
Very Sand  
Gravel  
Clay  
Boulders



## BORINGS BETWEEN 1930 FEET AND 1800 FEET WEST OF ROAD

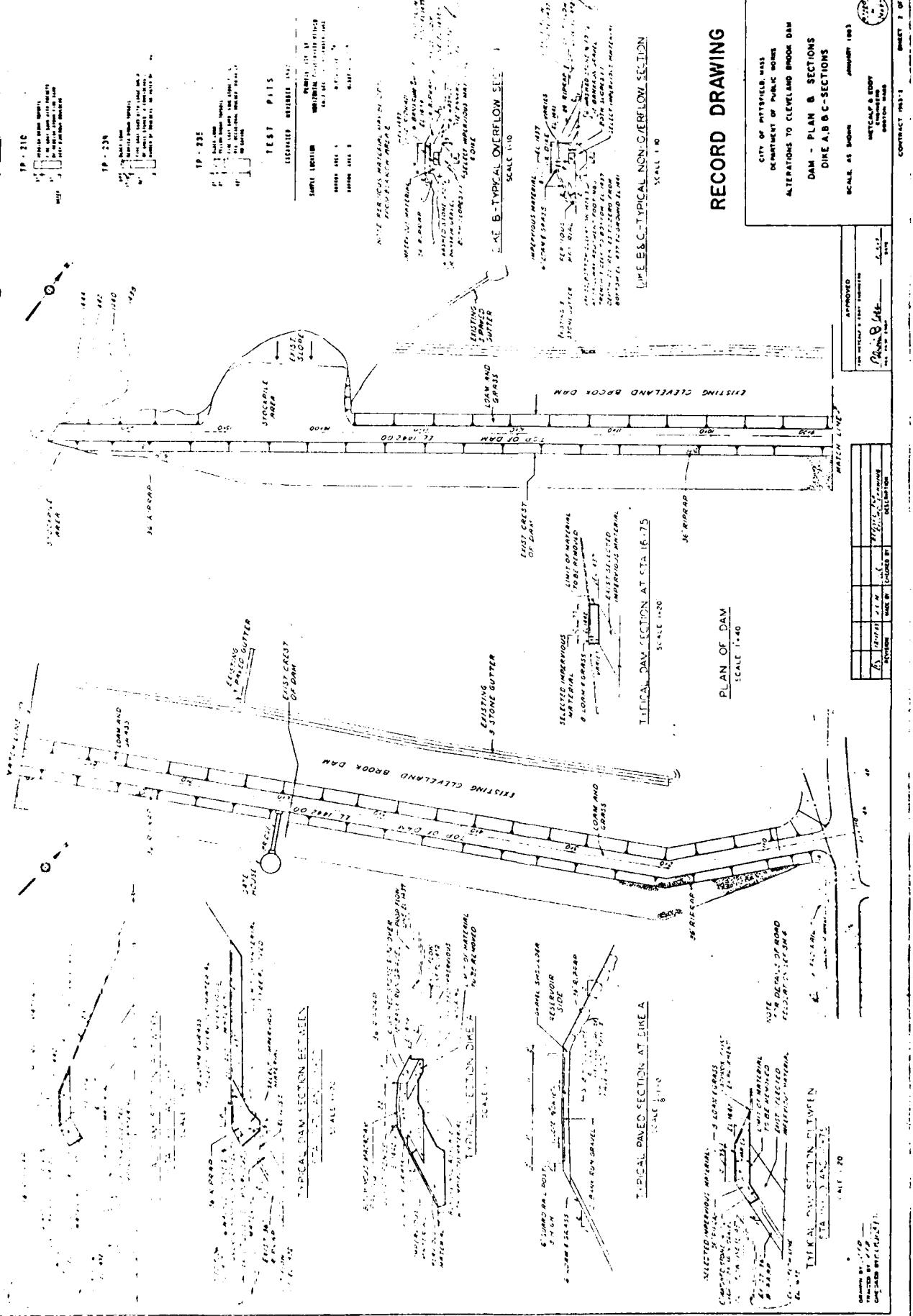
NO. 123-B

Sandy Loam  
and Boulders  
Fine Gravels  
Sand, Gravel  
and Boulders  
Fine Gravels Sand  
and Clay  
Boulders



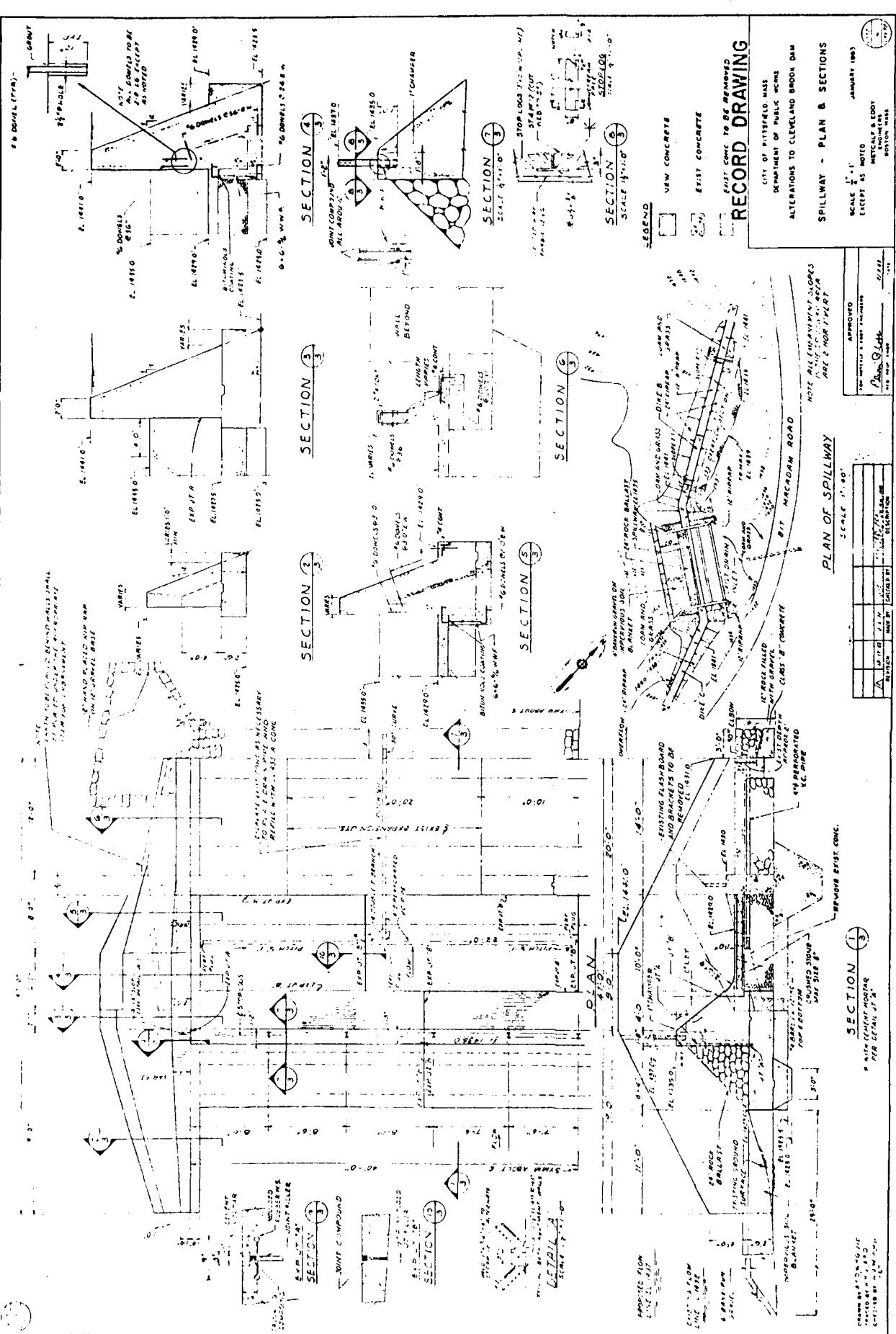
Note:  
For location of borings see Sheet  
Nos. 1, 2, 3, & 5.

PITTSFIELD, MASS.  
CLEVELAND ENGINEERS

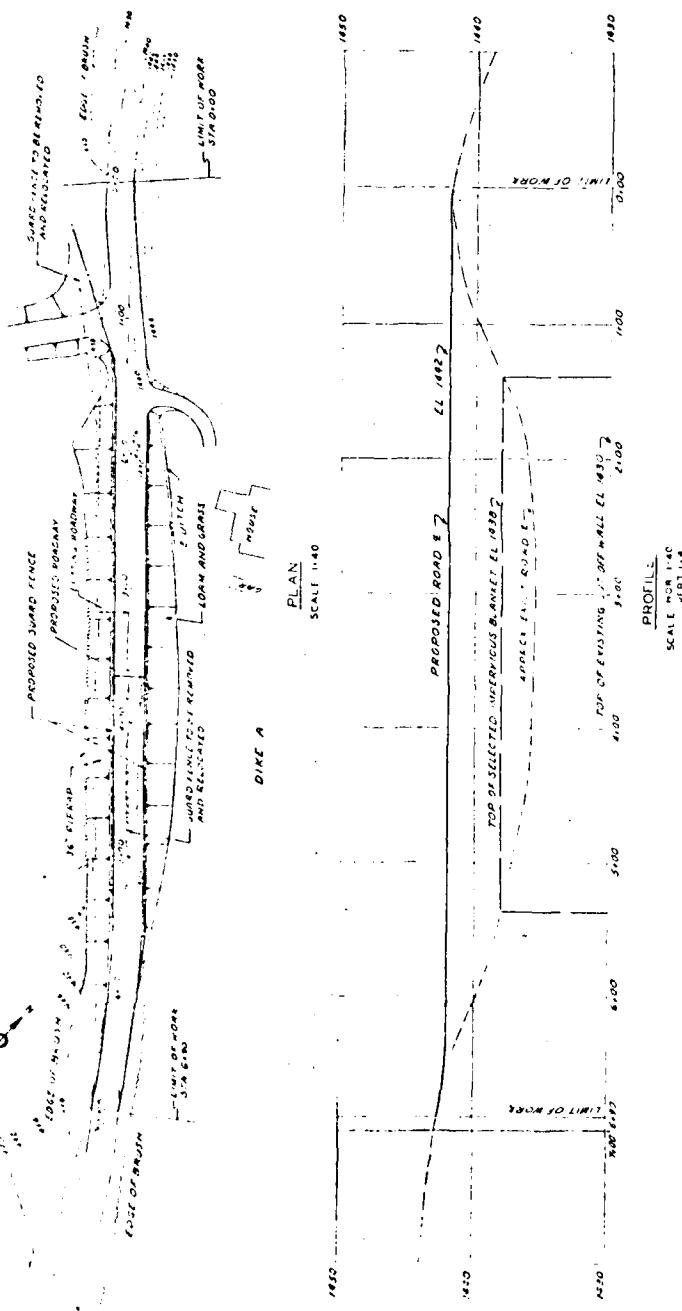


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APPENDIX B-31



APPENDIX B-32



**RECORD DRAWING**

July 28, 1976

Subject WATERWAYS-District One  
Hinsdale Cleveland Reservoir  
Dam No. 1-2-132-4

Mr. John Bartels, Chairman  
Board of Selectmen  
Dalton, MA 01226

Dear Sir

In answer to your letter of July 20, 1976 requesting information concerning the condition of the subject dam, we enclose a copy of the inspection report submitted to Boston Waterways in November, 1975. Please note that this report is of an advisory nature, and does not indicate an emergency situation.

The Pittsfield Water Department and District One personnel monitored the flow throughout the winter and spring of 1975-1976. No increase in flow was noted. Dye tests performed by consulting engineers were negative. This strengthened our belief that the flow is a spring and not a leak.

However, as we originally stated in the report, the size and location of this structure warrants in depth investigation of the condition. Not until an investigation is completed can anyone absolutely determine the true nature of this matter.

If we can be of further assistance, please contact the District One office.

Very truly yours

*Dean P. Amidon*

Dean P. Amidon, P. E.  
District Highway Engineer

RDJmkf  
Enclosure  
cc J. J. Mannon ✓  
Chief Engineer, DEQE  
SurvLen

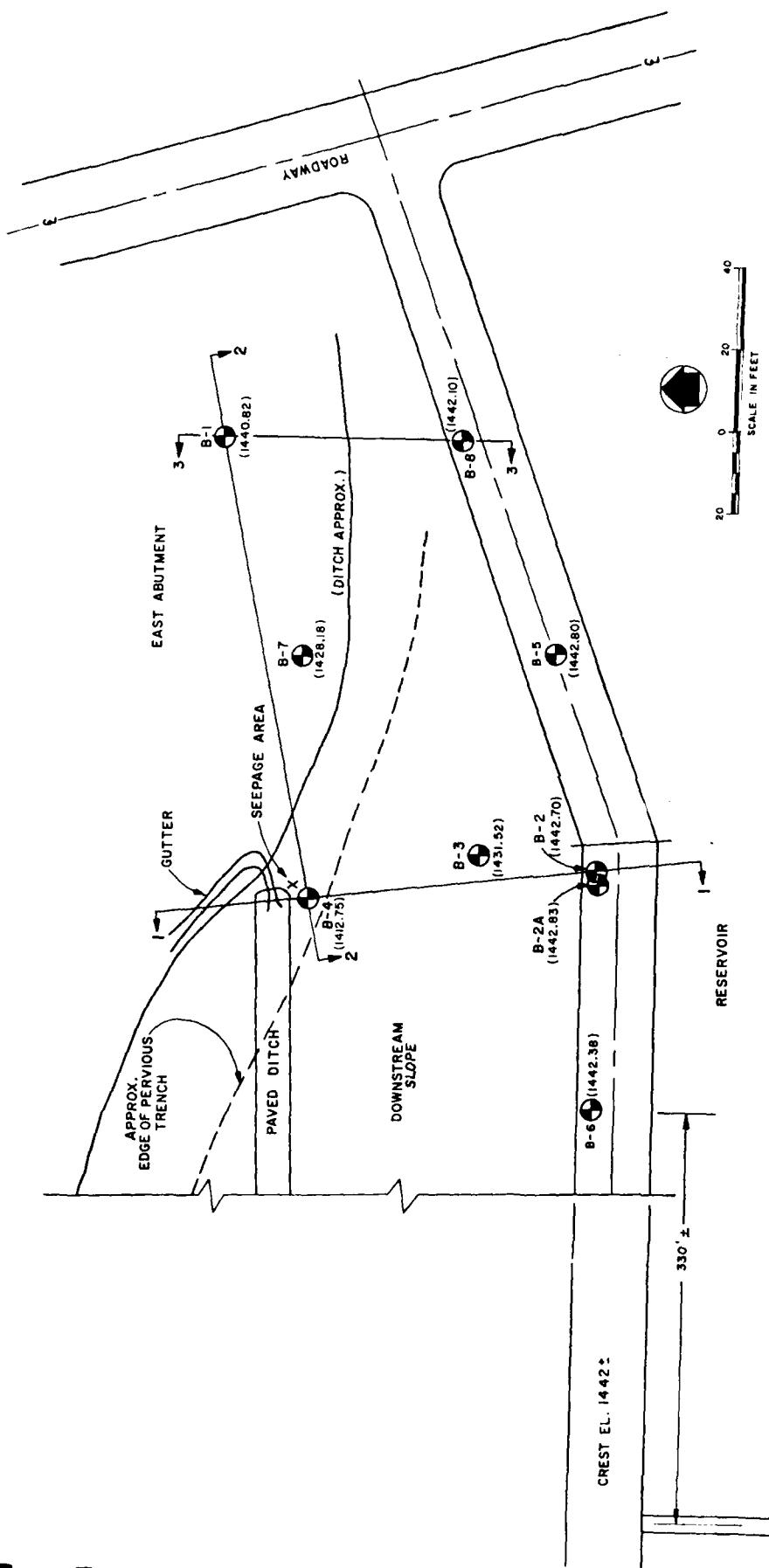


FIG. E-1 PLAN OF BORING LOCATIONS

(1963)  
GATE STRUCTURE  
FLOOR EL. 1438'

APPENDIXB-35

METCALF & EDDY

TABLE 1. RESULTS OF IN SITU FALLING HEAD PERMEABILITY TESTS

Perm No.	Boring	Depth (ft.)	Elevation	Permeability coefficient, K, cm/sec	Unified soil classification(1)	Blows/6"	Comments
				Initial Assumed	Interval		
1	B-1	37.5	1,403.30	$6 \times 10^{-4}$	$5 \times 10^{-4}$	SM	22-36-69-78 Foundation soil (abutment)
2	B-2	24.0	1,418.70	$4 \times 10^{-4}$	$1 \times 10^{-4}$	SM	29-64-46-32 Embankment soil (core)
3	B-2	30.0	1,412.82	$2 \times 10^{-3}$	$2 \times 10^{-3}$	SM	22-34-40-18 Embankment soil (near contact surface)
4	B-3	16.0	1,415.44	$3 \times 10^{-4}$	$2 \times 10^{-4}$	SP-SM	19-16-37-29 Embankment soil (semi-imperious zone)
5	B-3	20.0	1,411.44	$6 \times 10^{-4}$	$4 \times 10^{-4}$	SM	1-4-20-24 Foundation soil (near contact surface)
6	B-4	6.0	1,406.75	$2 \times 10^{-2}$	$5 \times 10^{-3}$	SP-SM	3-3-4-3 Within pervious toe
7	B-4	8.0	1,404.75	$2 \times 10^{-2}$	$9 \times 10^{-3}$	SM	3-3-3-40 Apparent contact (toe and foundation soil)
8	B-4	18.0	1,394.75	$1 \times 10^{-2}$	$1 \times 10^{-2}$	SM	7-9-14-20 Foundation soil
9	B-5	24.0	1,418.80	$3 \times 10^{-3}$	$1 \times 10^{-3}$	SP-SM	34-29-28-32 Foundation soil
10	B-5	28.0	1,414.80	$3 \times 10^{-3}$	$2 \times 10^{-3}$	SP-SM	22-12-12-17 Foundation soil
11	B-6	22.0	1,420.38	-	-	SM	13-14-17-28 Embankment soil (core)
12	B-6	30.0	1,412.38	$2 \times 10^{-3}$	$3 \times 10^{-4}$	GP-GM	37-51-63-79 Embankment soil (core)
13	B-7	20.0	1,408.18	$2 \times 10^{-3}$	$1 \times 10^{-3}$	SP-SM	9-12-15-17 Foundation soil
14	B-7	25.0	1,403.18	$1 \times 10^{-3}$	-	SP-SM	27-31 Foundation soil
15	B-8	15.0	1,427.25	$2 \times 10^{-4}$	$1 \times 10^{-4}$	SM	29-46-52-35 Foundation soil
16	B-8	21.0	1,421.25	$2 \times 10^{-3}$	$1 \times 10^{-3}$	SM	12-11-11-10 Foundation soil
17	B-8	27.0	1,415.25	$6 \times 10^{-3}$	$6 \times 10^{-3}$	No sample	14-11-10-9 Foundation soil
18	B-8	35.0	1,407.25	$1 \times 10^{-3}$	-	SM	19-20-56-33 Foundation soil

1. SM - silty sand.

SP-SM - Poorly graded silty sand.  
GP-GM - Poorly graded silty gravel.

TABLE 2. PIEZOMETERS - LOCATIONS AND WATER LEVEL MEASUREMENTS

Boring	Piez. No.	Date installed	Tip El. (ft.)	Water elevations in piezometers				
				Date - 9/16/76	9/17/76	9/20/76	9/21/76	9/22/76
3	P-1	9/10/76	1,401.94	1,421.12	1,424.07	1,421.62	1,421.13	1,426.02
3	P-2	9/10/76	1,411.04	1,421.22	1,423.72	1,420.82	1,421.42	1,420.32
3	P-3	9/13/76	1,421.44	1,422.00	1,422.02	Dry	1,421.72	Dry
4	P-4	9/14/76	1,397.75	-	1,409.35	1,406.95	1,405.90	1,408.75
4	P-5	9/14/76	1,405.75	-	1,411.70	1,409.35	1,411.60	1,411.45
2A	P-6	9/16/76	1,402.02	-	1,420.76	1,420.45	1,420.75	1,419.95
2A	P-7	9/16/76	1,407.32	-	1,422.71	1,422.95	1,422.75	1,422.95
2	P-8	9/16/76	1,411.50	-	1,423.48	1,423.48	1,423.56	1,421.18
2	P-9	9/16/76	1,421.40	-	1,423.48	1,423.58	1,422.38	1,421.08
7	P-10	9/16/76	1,410.18	-	1,421.15	1,420.48	1,420.78	1,416.38
8	P-11	9/20/76	1,410.10	-	-	Plugged	Plugged	Plugged
8	P-12	9/20/76	1,420.74	-	-	1,423.49	1,421.19	1,421.94
8	P-13	9/20/76	1,427.10	-	-	Dry	Dry	Dry
1	P-14	9/21/76	1,411.25	-	-	-	1,418.45	1,419.75
1	P-15	9/21/76	1,422.12	-	-	Dry	Dry	Dry

CLIENT: Metcalf & Eddy, Inc.				General Borings, Inc.				SHEET 1 OF 2	
				P. O. BOX 7135 PROSPECT, CONN. 06712				HOLE NO. B-1	
CONTRACTOR GBI #723				PROJECT NAME Cleveland Brook Reservoir Dam				LINE	
FOREMAN-DRILLER D.T. E.P.				LOCATION Hinsdale, Massachusetts				STATION	
INSPECTOR R.W.								OFFSET	
GROUND WATER OBSERVATIONS AT 18.75 FT. AFTER 0 HOURS AT 19.25 FT. AFTER 16 HOURS				CASING SAMPLER CORE BAR. TYPE HW SS NX SIZE I.D. 4" 3" 2 1/8" HAMMER WT. 300 LBS. BIT HAMMER FALL 18"				Start 9/7 Finish 9/9/76 DATE SURFACE ELEV. GROUND WATER ELEV.	
DEPTH	CASING SAMPLE			BLOWS PER 6" ON SAMPLER (FORCE ON TUBE)		CORING TIME PER FT. (MIN.) 0-6 8-12 12-18	DENSITY OR CONSIST.	STRATA CHANGE DEPTH MOIST ELEV.	FIELD IDENTIFICATION OF SOIL REMARKS INCL. COLOR, LOSS OF WASH WATER, SEAMS IN ROCK, ETC.
	NO.	TYPE	PEN REC.	DEPTH @ BOT.					
	1	ss	18"	14"	1.5'	2	4	7	dry 1.0'
	2	ss	18"	14"	3.0'	8	10	9	" "
5	3	ss	18"	8"	4.5'	6	6	7	" 6.0'
	4	ss	18"	10"	6.0'	4	6	5	" "
	5	ss	18"	9"	7.5'	16	29	31	dry very dense
10	6	ss	18"	14"	9.0'	32	56	59	" "
	7	ss	18"	18"	10.5'	36	74	110	moist
	8	ss	9"	6"	11.5'	64	150	13"	" "
	9	ss	18"	10"	14.5'	14	16	13	moist med.
15	10	ss	18"	12"	16.0'	11	31	16	moist dense
	11	ss	18"	14"	17.5'	12	22	24	" "
	12	ss	24"	4"	19.5'	13	14	14	16
20	13	ss	24"	5"	21.5'	16	13	26	" "
	14	ss	24"	14"	23.5'	31	46	14	32
25	1	C	36"	27"	26.5'	CORED			" "
	15	ss	12"	6"	28.5'	21	75		moist dense
30	16	ss	24"	16"	31.0'	21	26	31	37
	17	ss	24"	18"	33.0'	31	42	46	53
35	18	ss	24"	1"	35.5'	27	52	51	64
	19	ss	24"	10"	37.0'	27	36	61	78
40	20	s	1"	8"	37.75'	62	100	3"	" "
	1	ss	12"	7"	42.0'	56	150		" "
TOTAL FOOTAGE									
EARTH BORING _____ FT.									
ROCK CORING _____ FT.									

TYPE OF SAMPLES:  
 D=DRY W=WASHED C=CORED A=AUGER U=UNDISTURBED PISTON  
 UB=UNDISTURBED BALL C=CHECK VT=VANE TEST  
 PROPORTIONS USED TRACE<10% LITTLE<10-20% SOME<20-35%, AND<35-50%

CLIENT: Metcalf & Eddy, Inc.				General Borings, Inc.				SHEET 2 OF 2		
				P. O. BOX 7135 PROSPECT, CONN. 06712				HOLE NO. B-1		
CONTRACTOR GBI #723				PROJECT NAME Cleveland Brook Reservoir Dam				LINE		
FOREMAN-DRILLER D.T. E.P.				LOCATION Hinsdale, Massachusetts				STATION		
INSPECTOR R.W.								OFFSET		
GROUND WATER OBSERVATIONS AT 18.75 FT. AFTER 0 HOURS				CASING HW SAMPLER SS CORE BAR. NX				Start 9/7	Finish 9/9/76	
AT 19.25 FT. AFTER 16 HOURS				TYPE	4"	3"	2 1/8"	DATE SURFACE ELEV.		
				SIZE I.D.				GROUND WATER ELEV.		
				HAMMER WT.	300	LBS.	BIT			
				HAMMER FALL	18"					
DEPTH	CASING BLOWS PER FOOT	SAMPLE			BLOWS PER 6" ON SAMPLER (FORCE ON TUBE)	CORING TIME PER FT. (MIN.)	DENSITY OR CONSIST. STRATA CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL REMARKS INCL. COLOR, LOSS OF WASH WATER, SEAMS IN ROCK, ETC.		
		NO.	TYPE	PEN. REC.	@ BOT.	0-6 6-12 12-18		MOIST ELEV.		
45'		22	ss	18"	9"	41.5'	26 79 150	moist cored	18) Same as sample #17.	
							very	dense cobbles	19) Same as sample #17.	
							"	"	20) Same as sample #17, refusal at 37.75' cored cobbles.	
5		23	ss	12"	6"	45.0'	81 100	"	21) Same as sample #20.	
									22) Same as sample #20.	
50'		24	ss	6"	3"	46.5'	150		23) Same as sample #20.	
									24) Same as sample #20, drilled with tri-cone to 48.0'.	
10		25	ss	9"	6"	48.75'	37 100/3"	48.75' EOB	25) Same as sample #24.	
									END OF BORING 48.75' 45.75' Soil 3.0' Rock	
15										
20										
25										
30										
35										
40										
TYPE OF SAMPLES										
D=DRY	W=WASHED	C=CORED	A=SLAUGHTER	U=UNDISTURBED PISTON	TOTAL FOOTAGE					
L=UNDISTURBED PAIL CHECK				V=VANE TEST	EARTH BORING _____ FT.					
PROPORTIONS USED: TRACE < 10%				LITTLE > 10-20%	SOME > 20-35%, AND > 35-60%	ROCK CORING _____ FT.				

CLIENT: Metcalf & Eddy, Inc.	General Borings, Inc. P. O. BOX 7135 PROSPECT, CONN. 06712				Redrilled SHEET _____ OF _____ HOLE NO. B-1			
CONTRACTOR GBI #723	PROJECT NAME Cleveland Brook Reservoir Dam				LINE			
CREWMAN-DRILLER F.C. B.C.	LOCATION Hinsdale, Massachusetts				STATION			
INSPECTOR					OFFSET			
GROUND WATER OBSERVATIONS		CASING TYPE HW	SAMPLER SIZE I.D. 1/4"	CORE BAR. LBS.	Start DATE 9/21/76 Finish SURFACE ELEV. GROUND WATER ELEV.			
AT	FT. AFTER	HOURS	HAMMER WT.	BIT				
AT	FT. AFTER	HOURS	HAMMER FALL					
DEPTH	CASING BLOWS PER FOOT	SAMPLE NO. TYPE PEN REC. DEPTH & BOT.		BLOWS PER 6" ON SAMPLER FORCE ON TUBE	CORING TIME PER FT. (MIN.)	DENSITY OR CONSIST. MOIST.	STRATA CHANGE DEPTH ELEV.	FIELD IDENTIFICATION OF SOIL REMARKS INCL. COLOR, LOSS OF WASH WATER, SEAMS IN ROCK, ETC.
5	0-6 6-12 12-18							Ran casing to 31.5' to install Piezometers.
10								1st 30.6'
15								2nd 18.7'
20								
25								
30								
35								
TYPE OF SAMPLES: D=DRY W=WASHED C=CORED A=AUGER U=UNDISTURBED PISTON UB=UNDISTURBED BALL CHECK VT=VANE TEST						TOTAL FOOTAGE EARTH BORING FT. ROCK CORING FT.		
PROPORTIONS USED TRACE <10% LT=10-20% SOME=20-35%, AND >35-60%								

APPENDIX B-40

CLIENT: Metcalf & Eddy, Inc.		General Borings, Inc. P. O. BOX 7135 PROSPECT, CONN. 06712				SHEET <u>1</u> OF <u>1</u> HOLE NO. <u>B-2</u>
CONTRACTOR GHI #723		PROJECT NAME Cleveland Brook Reservoir Dam				LINe
DRILLER D.T. E.P.		LOCATION Hinsdale, Massachusetts				STATION
INSPECTOR R.W.						OFFSET
GROUND WATER OBSERVATIONS		CASING	SAMPLER	CORE BAR.	Start <u>9/10</u> Finish <u>9/10/70</u>	
AT _____ FT. AFTER _____ HOURS		TYPE 4"	HW 3"	NX 2 1/8"	DATE	
AT _____ FT. AFTER _____ HOURS		SIZE I.D. HAMMER WT. HAMMER FALL		300 LBS. BIT 18" Carb. & Diam.	SURFACE ELEV.	
DEPTH	CASING BLOWS PER FOOT	SAMPLE NO. TYPE PEN REC. DEPTH A.M.T.	BLOWS PER FT. IN SAMPLER FORCE ON TUBE	CORING TIME PER FT. (MIN.)	DENSITY OR CONSIST. DEPTH MOIST ELEV.	FIELD IDENTIFICATION OF SOIL REMARKS INCL. COLOR, LO.S OF WASH WATER, SEAMS IN RO. K. ETC.
0					.5'	1) Topsoil & brown fine-medium sand little fine gravel, trace silt. 2) Light brown fine-medium sand, trace fine gravel, trace silt.
5					5.0'	3) Gray-brown fine sand, little silt, little medium-fine gravel. 4) Same as sample #6, trace fractured rock. 5) Brown-gray fine-medium sand, trace silt, little fine-coarse gravel.
10					8.5'	6) Gray-brown coarse-fine sand, some fine gravel, trace silt. 7) Brown fine sand, trace fine gravel, trace silt. 8) Brown-gray fine sand, trace silt, trace coarse sand, trace fine gravel. 9) Same as sample #8, trace coarse gravel. 10) Same as sample #9. 11) Same as sample #9 12) Brown-gray fine-medium sand, trace silt, little coarse-grain gravel. 13) Same as sample #10. 14) Same as sample #10. 15) Same as sample #10.
15						
20						
25						
30					30.0'	NOTE: Cored 15" borer. Broke casing at 30.0' max. Boring 4.0' South.
35						END OF BORING 30.0' DEEP
40						
TYPE OF SAMPLE: DRY      WASHED      COOKED      ANGULAR      UNDISTURBED PISTON DRYING STATION TRACED TEST      VT-VANE TEST PROPORTIONS USED: TRACE 40%      10-15%      20%      SOME 20-35%, AND 35-50%						
TOTAL FOOTAGE EARTH BORING _____ FT ROCK CORING _____ FT						

CLIENT: Metcalf & Eddy, Inc.	General Borings, Inc.						SHEET <u>1</u> OF <u>1</u>	
	P. O. BOX 7135 PROSPECT, CONN. 06712						HOLE NO. <u>B-2-A</u>	
CONTRACTOR GBI #723	PROJECT NAME Cleveland Brook Reservoir Dam						LINE	
CREWMAN-DRILLER D.T. E.P.	LOCATION Hinsdale, Massachusetts						STATION	
INSPECTOR J.B.							OFFSET 4.0' South of B-2	
GROUND WATER OBSERVATIONS			CASING	SAMPLER	CORE BAR.	Start <u>9/15</u> Finish <u>9/15/76</u>		
AT _____ FT. AFTER _____ HOURS	TYPE	HW	SS			DATE		
AT _____ FT. AFTER _____ HOURS	SIZE I.D.	4"	3"			SURFACE ELEV. _____		
	HAMMER WT.	300 LBS.	BIT			GROUND WATER ELEV. _____		
DEPTH	CASING BLOWS PER FOOT	SAMPLE			BLOWS PER 6" ON SAMPLER (FORCE ON TUBE)	CORING TIME PER FT. OR CONSIST. (MIN.)	DENSITY CHANGE STRATA DEPTH	FIELD IDENTIFICATION OF SOIL REMARKS INCL. COLOR, LOSS (%), WASH WATER, SEAMS IN ROCK, ETC.
	NO.	TYPE	PEN	REC.	0-6 6-12 12-18		MOIST ELEV.	
35'	1	ss	18"	14"	33.51	25 46	118	Drilled casing 0.0'-30.0'. No samples, refusal on coring at 30.0', cored 12" boulder.
5		ss	24"	0"	36.01	29 156	24 42	1) Gray-brown fine-medium sand, little silt, trace fine-medium gravel.
10								NOTE: Spoon separated in hole, lost half, moved hole 3.0' south of B-2-A.
15								END OF BORING 36.0' total
20								Installed two piezometers:
25								1 at 30.75' 1 at 21.33'
30								
35								
TYPE OF SAMPLES: D=DRY W=WASHED C=CORED A=AUGER U=UNDISTURBED PISTON UB=UNDISTURBED BALL CHECK VT=VANE TEST							TOTAL FOOTAGE	
PROPORTIONS USED TRACE=10-10% LITTLE=10-20% SOME=20-35%, AND =35-50%							EARTH BORING _____ FT. ROCK CORING _____ FT.	

APPENDIX E-42

RD-A154 494

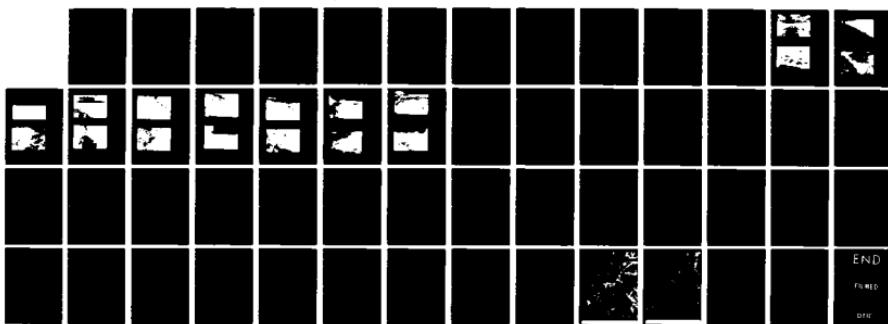
NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS  
CLEVELAND BROOK RESER. (U) CORPS OF ENGINEERS WALTHAM  
MA NEW ENGLAND DIV JUN 79

2/2

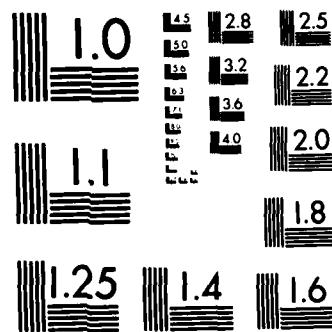
UNCLASSIFIED

F/G 13/13

NL



END  
FINISHED  
ONE



MICROCOPY RESOLUTION TEST CHART  
NATIONAL BUREAU OF STANDARDS 1963-A

CLIENT: Metcalf & Eddy, Inc.				General Borings, Inc.				SHEET <u>1</u> OF <u>1</u>		
				P. O. BOX 7135 PROSPECT, CONN. 06712				HOLE NO. <u>B-2-B</u>		
CONTRACTOR GBI #723		PROJECT NAME Cleveland Brook Reservoir Dam				LINE				
FOREMAN-DRILLER D.T. E.P.		LOCATION Hinsdale, Massachusetts				STATION				
INSPECTOR J.B.						OFFSET 3.0' South of B-2-A				
GROUND WATER OBSERVATIONS				CASING TYPE BW	SAMPLER SIZE I.D. <u>2 1/2"</u>	CORE BAR. 1 3/8"	Start <u>9/16</u> Finish <u>9/16, 7'</u>			
AT <u>19</u> FT. AFTER <u>      </u> HOURS				HAMMER WT. <u>140</u>	HAMMER FALL <u>30"</u>	SURFACE ELEV.				
AT <u>      </u> FT. AFTER <u>      </u> HOURS								GROUND WATER ELEV.		
DEPTH	CASING BLOWS PER FOOT	SAMPLE				Coring Time per ft. (min.) 0.6 6-12 12-18	Density or Consist. MOIST	Strata Change Depth Elev.	FIELD IDENTIFICATION OF SOIL REMARKS INCL. COLOR, LOSS OF WASH WATER, SEAMS IN ROCK, ETC.	
		NO.	TYPE	PEN	REC.				DEPTH @ BOT.	
35'								Drilled with BW casing	Drilled to 30.0', no sample taken. Permeability Test at 30.0'.	
5								moist	No recovery at 34.0'-35.0'.	
10'	1	ss	24" 0"	36.0'	21	14	12	moist	1) Brown fine-medium sand, little silt, trace fine-medium gravel.	
10'	2	ss	24" 16"	38.0'	11	10	11	medium	2) Same as sample #1, trace silt.	
10'	3	ss	24" 12"	40.0'	14	17	14	dense	3) Same as sample #2.	
10'	4	ss	24" 9"	42.0'	11	16	21	"	4) Same as sample #1, little silt.	
10'	5	ss	24" 12"	44.0'	9	10	10	moist	5) Same as sample #4.	
15'								medium	Refusal at 45.5' cored 1.0' boulders and cobbles to 46.0'.	
15'	5	ss	18" 10"	45.5'	12	19	27	dense	6) Gray-brown fine-medium sand, little silt, little fine-medium gravel.	
20'	c	ss	24" 12"	50.0'	11	21	16	moist	7) Same as sample #6, some fractured rock.	
20'	7	ss	24" 14"	52.0'	16	22	27	dense	8) Brown-gray fine-medium sand, trace silt, trace fine-medium gravel.	
25'	8	ss	24" 18"	54.0'	33	52	41	very	END OF BORING 54.0' DEEP	
25'									Installed two piezometers 1 at 40.75' 1 at 35.0'	
30										
35										
40										
TYPE OF SAMPLES: D=DRY W=WASHED C=CORED A=AUGER U=UNDISTURBED PISTON UB=UNDISTURBED BALL CHECK VT=VANE TEST										TOTAL FOOTAGE
PROPORTIONS USED TRACE=0-10% LITTLE=10-20% SOME=20-35%, AND =35-60%										EARTH BORING _____ FT. ROCK CORING _____ FT

APPENDIX B-43

CLIENT: Metcalf & Eddy, Inc.				General Borings, Inc. P. O. BOX 7135 PROSPECT, CONN. 06712				SHEET <u>1</u> OF <u>1</u> HOLE NO. <u>B-3</u>
CONTRACTOR <u>GBI #723</u>		PROJECT NAME <u>Cleveland Brook Reservoir Dam</u>				LINE		
FOREMAN-DRILLER <u>F.C. B.C.</u>		LOCATION <u>Hinsdale, Massachusetts</u>				STATION		
INSPECTOR <u>J.B.</u>						OFFSET		
GROUND WATER OBSERVATIONS AT <u>9.5</u> FT. AFTER <u>      </u> HOURS				TYPE	CASING <u>4"</u>	SAMPLER <u>3"</u>	CORE BAR.	Start <u>9/8</u> Finish <u>9/8/76</u>
AT <u>      </u> FT. AFTER <u>      </u> HOURS				SIZE I.D.				SURFACE ELEV.
				HAMMER WT.	<u>300</u> LBS.	BIT <u>18"</u>		GROUND WATER ELEV.
DEPTH	SAMPLE			BLOWS PER 6" (FORCE ON TUBE)	CORING TIME PER FT. (MIN.)	DENSITY OR CONSIST. (MIN.)	STRATA CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL MARKS INCL. COLOR, LOSS OF WASH WATER, SEAMS IN ROCK, ETC.
	NO.	TYPE	PEN					REC.
0	1	ss	24"	10"	2.0'	dry	0.0'-19.0' cobbles and coarse gravel.	
5	2	ss	24"	12"	4.0'	loose	1) Brown fine sand & coarse gravel, trace silt.	
5	3	ss	24"	10"	6.0'	dense	2) Brown fine sand & medium gravel, trace silt.	
5	4	ss	24"	5"	8.0'	wet	3) Brown fine-coarse sand, trace fine gravel, trace silt.	
10	5	ss	24"	12"	10.0'	very dense	4) Brown medium-coarse sand, trace silt and coarse gravel.	
10	6	ss	24"	13"	12.0'	wet	5) Brown fine-medium sand, trace silt & coarse gravel.	
10	7	c	24"		14.0'	dense	6) Brown medium-fine sand, little silt, trace coarse-medium gravel.	
15	8	ss	24"	15"	16.0'	wet	7) Cored 12.0'-14.0', boulder 12.0'-13.0'.	
15	9	ss	24"	12"	18.0'	medium	8) Brown fine-medium sand, little silt & coarse gravel.	
20	10	ss	24"	18"	20.0'	wet	9) Brown medium-coarse sand & medium-coarse gravel, trace silt.	
20	11	ss	24"	14"	22.0'	dense	10) 1st 12"-layer wood fibers, trace peat and loose, brown fine sand, coarse gravel. Last 12" brown fine sand, little silt, trace medium-coarse gravel.	
25	12	ss	24"	16"	24.0'	wet	11) Brown fine-medium sand & medium-coarse gravel.	
25	13	ss	24"	10"	26.0'	dense	12) Brown fine sand, trace silt, little medium-fine gravel.	
30	14	ss	24"	20"	28.0'	wet	13) Brown fine sand, trace silt, trace fine-coarse gravel.	
30	15	ss	24"	16"	30.0'	very dense	14) Brown fine sand.	
30						wet	15) Brown fine sand, little silt, little medium-coarse gravel.	
35						dense		
40								
TOTAL FOOTAGE EARTH BORING <u>      </u> FT. ROCK CORING <u>      </u> FT.								
TYPE OF SAMPLES: D=DRY      W=WASHED      C=CORED      A=AUGER      U=UNDISTURBED PISTON UB=UNDISTURBED BALL CHECK      V=VANE TEST PROPORTIONS USED: TRACE=0-10%      LITTLE=10-20%      SOME=20-35%, AND=35-60%								

CLIENT: Metcalf & Eddy, Inc.				General Borings, Inc.				SHEET 1 OF 1	
				P. O. BOX 7135 PROSPECT, CONN. 06712				HOLE NO. B-4	
CONTRACTOR GBI #723		PROJECT NAME Cleveland Brook Reservoir Dam		LINE					
FOREMAN-DRILLER F.C. B.C.		LOCATION Hinsdale, Massachusetts		STATION					
INSPECTOR J.B.				OFFSET					
GROUND WATER OBSERVATIONS				CASING	SAMPLER	CORE BAR.		Start 9/13	Finish 9/13/76
AT 1 FT. AFTER 0 HOURS	TYPE HW	SS 3		SIZE I.D. 4"				DATE SURFACE ELEV.	
AT _____ FT. AFTER _____ HOURS	HAMMER WT. 300 LBS.	BIT 18"		HAMMER FALL				GROUND WATER ELEV.	
DEPTH	SAMPLE			BLOWS PER 6' ON SAMPLER (FORCE ON TUBE)	CORING TIME PER FT. (MIN.)	DENSITY OR CONSIST.	STRATA CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL REMARKS INCL. COLOR, LOSS OF WASH WATER, SEAMS IN ROCK, ETC.	
	NO.	TYPE	PEN REC.	0-6 6-12 12-18		MOIST	ELEV.		
5	1 ss 24" 10" 2.0'	1 3 4	4	wet loose	7.5'		1) Brown fine-medium sand, little silt, trace fine-coarse gravel. 2) Brown fine-medium sand, little silt and medium-fine gravel. 3) Brown fine-medium sand, little silt, trace medium-coarse gravel. 4) Brown fine-medium sand, little silt, trace medium-coarse gravel. 5) Brown fine sand and medium-coarse gravel, little silt. 6) Brown fine sand, little silt, little medium-fine gravel. 7) Brown medium-fine sand, little silt, trace medium-fine gravel. 8) Brown medium-fine sand, little fine gravel. 9) Brown fine sand, little silt and medium-fine gravel. 10) Brown fine-medium sand, little silt, trace fine-medium gravel. 11) Brown fine sand, trace medium-coarse gravel, little silt, little mica-schist mixed. NOTE: Ran core barrel 22.0'-25.0'. boulder on boulder.		
10	2 ss 24" 11" 4.0'	2 3 4	3	"					
15	3 ss 24" 9" 6.0'	3 3 4	3	"					
20	4 ss 24" 11" 8.0'	3 3 3	40	wet dense					
25	5 ss 24" 10" 10.0'	15 20 15	23	"					
30	6 ss 24" 15" 12.0'	9 20 14	16	wet medium					
35	7 ss 24" 13" 14.0'	10 14 16	15	wet dense					
40	8 ss 24" 14" 16.0'	9 10 9	11	wet medium					
	9 ss 24" 24" 18.0'	7 9 14	20	wet dense					
	10 ss 24" 12" 20.0'	10 11 9	10	wet medium	21.5'				
	11 ss 24" 23" 22.0'	7 10 29	73	wet very dense	25.0'	EOB	END OF BORING 25.0' Soil Installed two Piezometers 1st - 15.0' 2nd - 7.5'		
TOTAL FOOTAGE									
EARTH BORING _____ FT.									
ROCK CORING _____ FT.									
TYPE OF SAMPLES: D=DRY W=WASHED C=CORED A=AUGER UP=UNDISTURBED PISTON UB=UNDISTURBED BALL CHECK VT=VANE TEST									
PROPORTIONS USED TRACE<10% LITTLE>10-20% SOME>20-35%, AND>35-50%									

APPENDIX B-45

CLIENT: Metcalf & Eddy, Inc.	General Borings, Inc. P. O. BOX 7135 PROSPECT, CONN. 06712				SHEET 1 OF 1 HOLE NO. B-4-A			
CONTRACTOR GBI #723	PROJECT NAME Cleveland Brook Reservoir Dam				LINE			
DRILLER F.C. B.C.	LOCATION Hinsdale, Massachusetts				STATION			
INSPECTOR J.B.					OFFSET			
GROUND WATER OBSERVATIONS AT 5 FT. AFTER HOURS		CASING HW	SAMPLER SS	CORE BAR.	Start 9/15 Finish 9/15/70			
AT FT. AFTER HOURS		SIZE I.D. 4"	3"		SURFACE ELEV.			
		HAMMER WT. 300	18" LBS. BIT		GROUND WATER ELEV.			
DEPTH	CASING BLOWS PER FOOT	SAMPLE NO. TYPE PEN REC. DEPTH @ BOT.		BLOWS PER 6" ON SAMPLER (FORCE ON TUBE)	CORING TIME PER FT. (MIN.)	DENSITY OR CONSIST.	STRATA CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL REMARKS INCL. COLOR, LOSS OF WASH WATER, SEAMS IN ROCK, ETC
		0-6	6-12	12-18		MOIST	ELEV.	
5								Ran Casing 3.0' and took Permeability Test for 3 minutes.
10								
15								
20								
25								
30								
35								
40								
TYPE OF SAMPLES D=DRY W=WASHED C=CORED A=AUGER UP=UNDISTURBED PISTON UB=UNDISTURBED BALL CHECK VT=VANE TEST PROPORTIONS USED TRACE=0-10% LITTLE=10-20% SOME=20-35%, AND =35-60%								
TOTAL FOOTAGE EARTH BORING _____ FT. ROCK CORING _____ FT.								

APPENDIX B-46

CLIENT: Metcalf & Eddy, Inc.				General Borings, Inc. P. O. BOX 7135 PROSPECT, CONN. 06712				SHEET 1 OF 1 HOLE NO. B-5		
CONTRACTOR GRI #723		PROJECT NAME Cleveland Brook Reservoir Dam				LINE				
REMAN-DRILLER D.T. E.P.		LOCATION Hinsdale, Massachusetts				STATION				
INSPECTOR J.B.						OFFSET				
GROUND WATER OBSERVATIONS AT 18.25 FT. AFTER 0 HOURS				CASING TYPE	HW 4"	SAMPLER SS 3"	CORE BAR.		Start 9/20	Finish 9/21/76
AT _____ FT. AFTER _____ HOURS				SIZE I.D. HAMMER WT.			300 LBS.	BIT 18"	DATE SURFACE ELEV.	
				HAMMER FALL					GROUND WATER ELEV.	
DEPT.	CASING BLOWS PER FOOT	SAMPLE			BLOWS PER 6" ON SAMPLER (FORCE ON TUBE)	CORING TIME PER FT. (MIN.)	DENSITY OR CONSIST.	STRATA CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL REMARKS INCL. COLOR, LOSS OF WASH WATER, SEAMS IN ROCK, ETC.	
		NO.	TYPE	PEN. REC.	DEPTH @ BOT.	0-6 6-12 12-18		MOIST ELEV.		
		1	ss	24"	9' 2.0'	9	17	16	17	dry .5"
		2	ss	24"	12' 4.0'	8	21	16	29	dense "
5		3	ss	24"	20' 6.0'	16	27	39	38	moist very dense
		4	ss	24"	10' 8.0'	21	20	32	26	" "
10		5	ss	24"	12' 10.0'	28	36	32	26	" "
		6	ss	24"	10' 12.0'	20	30	35	55	" 12.83"
15		7	ss	4"	4" 2.83"	75/1"				" "
			ss	0"	0" 14.0'	50/0"				16.0"
		8	ss	24"	5" 18.0'	29	56	42	55	" "
20		9	ss	24"	7" 20.0'	27	39	26	35	" "
		10	ss	24"	6" 22.0'	29	56	54	61	" "
25		11	ss	24"	12" 24.0'	34	29	28	32	" "
			ss	24"	0" 26.0'	11	14	17	18	moist
30		12	ss	24"	14" 28.0'	22	12	12	17	medium
		13	ss	24"	3" 30.0'	21	17	20	16	moist
35		14	ss	24"	10" 32.0'	16	14	15	17	dense
		15	ss	24"	12" 34.0'	16	19	17	21	" "
		16	ss	24"	14" 36.0'	15	15	16	19	" "
									36.0"	BOB
TOTAL FOOTAGE										
EARTH BORING _____ FT.										
ROCK CORING _____ FT.										

CLIENT: Metcalf & Eddy, Inc.				General Borings, Inc.				SHEET 1 OF 1			
				P. O. BOX 7135 PROSPECT, CONN. 06712				HOLE NO. B-6			
CONTRACTOR		PROJECT NAME						LINE			
GHI #723		Cleveland Brook Reservoir Dam						STATION			
FOREMAN-DRILLER		LOCATION						OFFSET			
F.C. B.C.		Hinsdale, Massachusetts									
INSPECTOR		J.B.									
GROUND WATER OBSERVATIONS				CASING		SAMPLER	CORE BAR.	Start 9/16 Finish 9/16/70			
AT 17.5' FT. AFTER HOURS				TYPE	HW	SS		DATE			
				SIZE I.D.	4"	3"		SURFACE ELEV.			
				HAMMER WT.	300 LBS.	BIT		GROUND WATER ELEV.			
				HAMMER FALL							
DEPTH	CASING BLOWS PER FOOT	SAMPLE			BLOWS PER 6" ON SAMPLER (FORCE ON TUBE)	CORING TIME PER FT. (MIN.)	DENSITY OR CONSIST.	STRATA CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL REMARKS INCL. COLOR, LOSS OF WASH WATER, SEAMS IN ROCK, ETC.		
		NO.	TYPE	PEN. REC.	@ 80T.	0.6 6-12 12-18		MOIST ELEV.			
		1	ss	24"	13"	2.0	4 7 10 10	dry	1) Brown fine sand, little silt, little medium-fine gravel.		
		2	ss	24"	16"	4.0	10 11 27 40	medium dry	2) Brown fine sand, little silt and coarse gravel.		
5		3	ss	24"	13"	6.0	23 21 24 30	very dense	3) Brown fine sand, little silt, trace medium-coarse gravel.		
		4	ss	24"	14"	8.0	19 28 32 41	"	4) Brown fine sand, little silt, trace fine-medium gravel.		
		5	ss	24"	13"	10.0	23 39 47 62	wet	5) Brown medium-coarse sand, little silt, trace medium-coarse gravel.		
10		6	ss	24"	5"	12.0	37 49 67 74	very dense	6) Brown fine-medium sand, trace coarse gravel.		
		7	ss	24"	11"	14.0	31 23 27 38	"	7) Brown fine-medium sand, trace fine-medium gravel.		
15		8	ss	24"	12"	16.0	10 23 27 30	"	8) Brown medium-fine sand, little silt, trace fine-medium gravel.		
		9	ss	24"	13"	18.0	19 18 27 26	"	9) Brown-gray fine-medium sand, little silt, trace medium-fine gravel.		
20		10	ss	24"	8"	22.0	13 14 17 28	wet	NOTE: Cored 18.0'-19.5', ran into boulder, ran casing to 20.0', recovered 1.5'.		
		11	ss	24"	10"	24.0	16 17 23 26	dense	10) Brown fine-medium sand, little silt, trace fine-medium gravel.		
25		12	ss	24"	17"	26.0	26 34 39 41	wet	11) Brown fine sand, little silt, trace medium-coarse gravel.		
		13	ss	24"	14"	28.0	31 47 56 59	very dense	12) Brown fine sand, little silt, trace medium-fine gravel.		
30		14	ss	24"	11"	30.0	37 51 63 79	"	13) Brown fine-medium sand, little silt, trace medium-coarse gravel.		
							30.0'	EOB	14) Brown-gray fine-medium sand, little silt, trace medium-fine gravel.		
35									END OF BORING 30.0' EOB		
40											
TYPE OF SAMPLES:											
D=DRY	W=WASHED	C=CORED	A=AUGER	LIP=UNDISTURBED PISTON	TOTAL FOOTAGE						
UB=UNDISTURBED BALL CHECK				VT=VANE TEST	EARTH BORING _____ FT.						
PROPORTIONS USED	TRACE <0-10%	LITTLE >10-20%	SOME >20-35%, AND >35-50%		ROCK CORING _____ FT.						

CLIENT: Metcalf & Eddy, Inc.				General Borings, Inc.				SHEET <u>1</u> OF <u>1</u>		
				P. O. BOX 7135 PROSPECT, CONN. 06712				HOLE NO. <u>B-7</u>		
CONTRACTOR		PROJECT NAME						LINE		
GBI #723		Cleveland Brook Reservoir Dam								
JOEMAN DRILLER		LOCATION						STATION		
F.C. B.C.		Hinsdale, Massachusetts								
INSPECTOR								OFFSET		
J.B.										
GROUND WATER OBSERVATIONS				CASING		SAMPLER	CORE BAR.	Start	Finish	
AT	6.25	FT. AFTER	0	HOURS	TYPE	HW	SS	DATE	9/15 9/15/76	
AT		FT. AFTER		HOURS	SIZE I.D.	4"	3"	SURFACE ELEV.		
					HAMMER WT.	300	LBS. BIT	GROUND WATER ELEV.		
					HAMMER FALL	18"				
DEPTH	SAMPLE			BLOWS PER 6"		CORING TIME PER FT.	DENSITY OR CONSIST.	STRATA CHANGE DEPTH	FIELD IDENTIFICATION OF SOIL REMARKS INCL. COLOR, LOSS OF WASH WATER, SEAMS IN ROCK, ETC.	
	NO.	TYPE	PEN REC.	DEPTH @ BOT.	ON SAMPLER (FORCE ON TUBE)	(MIN.)	MOIST	ELEV.		
					0-6	6-12	12-18			
5	1	ss	24"	14"	2.0'	3	2	3	2	dry
	2	ss	24"	11"	4.0'	3	2	3	9	loose
	3	ss	24"	15"	6.0'	9	17	17	31	dry
	4	ss	24"	13"	8.0'	28	27	31	35	medium
10	5	ss	24"	16"	10.0'	10	17	16	11	moist
	6	ss	24"	13"	12.0'	10	13	12	14	dense
	7	ss	24"	14"	14.0'	13	14	13	14	moist
	8	ss	24"	16"	16.0'	11	10	13	20	very dense
15	9	ss	24"	16"	18.0'	11	15	10	14	wet
	10	ss	24"	14"	20.0'	9	12	15	17	medium
	11	ss	24"	16"	22.0'	15	27	34	41	"
	12	ss	24"	11"	24.0'	27	34	49	61	very dense
25	13	ss	12"	6"	25.0'	27	31			"
										20.5'
										25.0'
										EOB
TOTAL FOOTAGE										
EARTH BORING _____ FT.										
ROCK CORING _____ FT.										
TYPE OF SAMPLES D=DRY W=WASHED C=CORED A=AUGER UP=UNDISTURBED PISTON UB=UNDISTURBED BALL CHECK VT=VANE TEST										
PROPORTIONS USED TRACE <10% LITTLE >10-20% SOME >20-35% AND >35-50%										

CLIENT: Metcalf & Eddy, Inc.				General Borings, Inc.				SHEET <u>1</u> OF <u>1</u> HOLE NO. <u>B-8</u>	
CONTRACTOR GBI #723				PROJECT NAME Cleveland Brook Reservoir Dam				LINE	
CREWMAN-DRILLER D.T. E.P.				LOCATION Hinsdale, Massachusetts				ELEVATION	
INSPECTOR J.B.								OFFSET	
GROUND WATER OBSERVATIONS AT <u>14</u> FT. AFTER <u>24</u> HOURS				CASING <u>HW</u> SAMPLER <u>SS</u> CORE BAR.				Start <u>9/16</u> Finish <u>9/20/76</u>	
AT _____ FT. AFTER _____ HOURS				TYPE	SIZE I.D.	HAMMER WT.	HAMMER FALL	SURFACE ELEV.	GROUND WATER ELEV.
DEPTH	CASING BLOWS PER FOOT	SAMPLE			BLOWS PER 6" ON SAMPLER (FORCE ON TUBE)	CORING TIME PER FT. (MIN.)	DENSITY OR CONSIST. STRATA CHANGE	FIELD IDENTIFICATION OF SOIL REMARKS INCL. COLOR, LOSS OF WASH WATER, SEAMS IN ROCK, ETC.	
		NO.	TYPE	PEN REC.	0-6 6-12 12-18		MOIST ELEV.		
5		1	ss	24" 19"	2.0	9 11 10	dry	1) Topsoil and light brown fine medium sand, trace silt, trace fine gravel.	
		2	ss	24" 20"	4.0	13 15 21	medium	2) Same as sample #1, trace medium gravel.	
10		3	ss	24" 20"	6.0	16 29 56	very dense	3) Gray-brown fine-medium sand, trace silt, trace fine-medium gravel, trace coarse gravel.	
		4	ss	24" 18"	8.0	14 30 33	"	4) Same as sample #3, no coarse gravel.	
15		5	ss	24" 14"	10.0	19 24 32	"	5) Same as sample #4.	
		6	ss	12" 8"	11.0	36 100	moist	6) Brown-gray fine-medium sand, trace coarse sand, trace silt, some fine-coarse gravel.	
20		7	ss	24" 16"	15.0	29 46 52	"	NOTE: Refusal at 11.0', cored cobbles to 13.0'	
		8	ss	24" 18"	17.0	27 36 39	"	7) Brown fine-medium sand, trace silt, some fine-medium gravel.	
25		9	ss	24" 19"	19.0	19 20 16	moist	8) Brown-gray fine sand, some silt, some fine-medium gravel.	
		10	ss	24" 19"	21.0	12 11 11	medium	9) Brown fine-medium sand, trace silt, little fine-medium gravel.	
30		11	ss	24" 6"	23.0	6 8 5 5	"	10) Brown fine-medium sand, little silt, little fine gravel, trace fractured rock.	
		12	ss	24" 0"	25.0	8 8 7 8	wet	11) Brown fine-medium sand, little silt, little fine-medium gravel.	
35		13	ss	24" 3"	27.0	14 11 10 9	medium	Note: No recovery at 25.0'.	
		14	ss	24" 9"	29.0	7 8 7 9	"	12) Brown fine-medium sand, little fine-medium gravel, trace silt.	
40		15	ss	24" 16"	31.0	8 29 21 19	wet	13) Same as sample #12.	
		16	ss	24" 12"	33.0	12 16 15 17	dense	14) Same as sample #12.	
						35.0' EOB	15) Same as sample #12.		
							16) Same as sample #12, some coarse gravel.		
								TOTAL FOOTAGE	
								EARTH BORING _____ FT	
								ROCK CORING _____ "	
TYPE OF SAMPLES: D=DRY W=WASHED C=CORED A=AUGER U=UNDISTURBED PISTON UB=UNDISTURBED BALL CHECK V=VANE TEST				PROPORTIONS USED: TRACE=0-10% LITTLE=10-20% SOME=20-35%, AND=35-50%					

APPENDIX C  
SELECTED PHOTOGRAPHS OF PROJECT

LOCATION PLAN

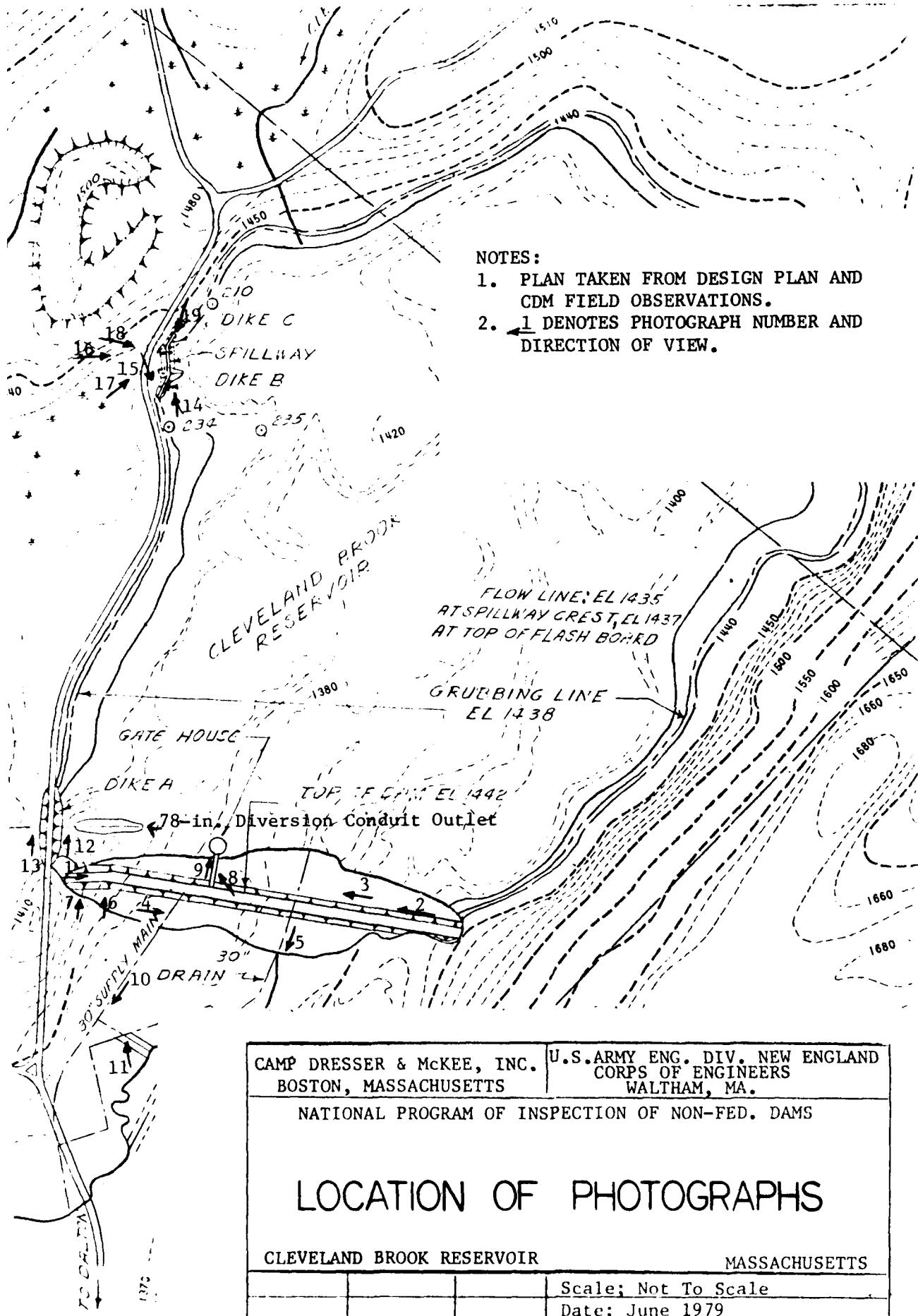
Location of Photographs

Page No.

C-1

PHOTOGRAPHS

<u>No.</u>	<u>Title</u>	<u>Page No.</u>
1.	Overview of Dam From Right Abutment	iv
2.	Crest of Dam From Left of Dam	C-2
3.	Riprap at Upstream Face of Dam	C-2
4.	Downstream Face of Dam Viewed From Right Side	C-3
5.	Reservoir Drain and Drainage Pipe Outlet at Toe of Dam	C-3
6.	Observation Wells on Downstream Face of Dam Near Right Abutment	C-4
7.	Seepage and Flow Measuring Pipe on Downstream Face of Dam Near Right Abutment	C-4
8.	Intake Gatehouse (Control Tower) for Water Transmission Main	C-5
9.	Interior of Gatehouse	C-5
10.	Valve Chamber on Water Transmission Main Downstream of Dam	C-6
11.	Headwall for Blow-Off From Transmission Main Valve Chamber	C-6
12.	Upstream Face of Dike A From Dam Right Abutment	C-7
13.	Crest and Downstream Face of Dike A From West End	C-7
14.	Overview of Dike B and Overflow Spillway From West End	C-8
15.	Riprap Protection of Overflow Spillway Invert	C-8
16.	Spillway Weir From Downstream of Dike B	C-9
17.	Seepage Downstream of Spillway Discharge Apron	C-9
18.	View Towards Spillway From Downstream	C-10
19.	Overview of Dike C From East End	C-10





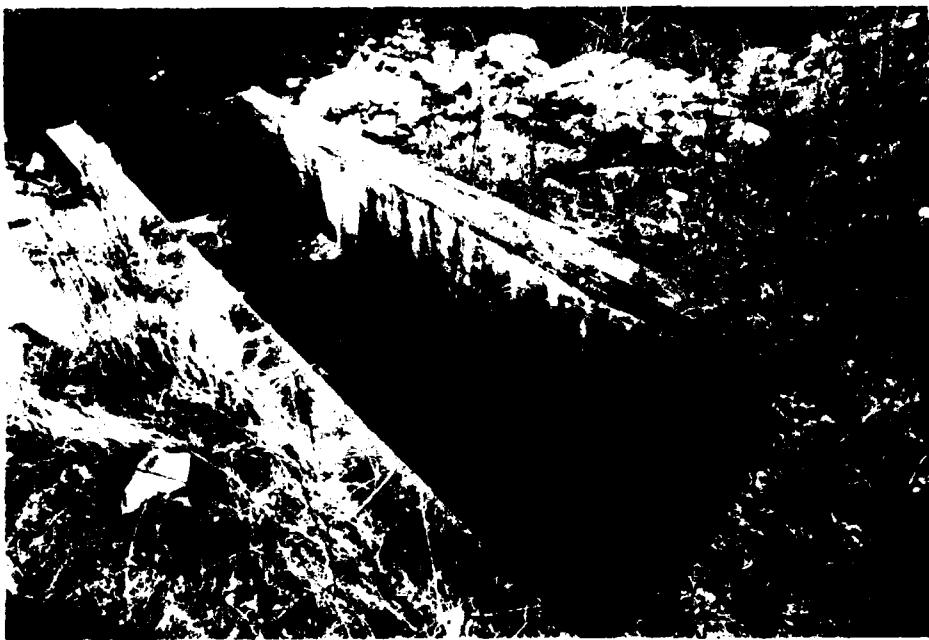
2. CREST OF DAM FROM LEFT OF DAM.



3. RIPRAP AT UPSTREAM FACE OF DAM.



4. DOWNSTREAM FACE OF DAM VIEWED FROM RIGHT SIDE.



5. RESERVOIR DRAIN AND DRAINAGE PIPE OUTLET AT TOE OF DAM.

CAMP DRESSER &amp; MCKEE INC.

CLIENT COE  
PROJECT Dam Env.  
DETAIL Cleveland Brat ResJOB NO 380-6-RT-10 PAGE 5  
DATE CHECKED 7/20/79 DATE 7-18-79  
CHECKED BY JED COMPUTED BY Jae H.Stage - Discharge Relationship

Stage from LSL El.	Spillway	Right Embankment			Left Embankment			Main Dam	Dike A	Total
		Q <sub>3</sub>	Q <sub>41</sub>	Q <sub>42</sub>	Q <sub>43</sub>	Q <sub>44</sub>	Q <sub>45</sub>			
1437	-	-	-	-	-	-	-	-	-	ZERO
1438	266	-	-	-	-	-	-	-	-	266
1439	750	-	-	-	-	-	-	-	-	750
1440	1375	-	-	-	-	375	-	-	-	1750
1441	2110	-	-	-	-	1028	-	-	-	3138
1442	2941	294	10	-	126	1911	112	10	-	5404

CAMP DRESSER &amp; MCGEE INC

CLIENT COE

PROJECT Dam Imp.

DETAIL Cleveland Brook Reservoir

JOB NO 380-6-RT-10

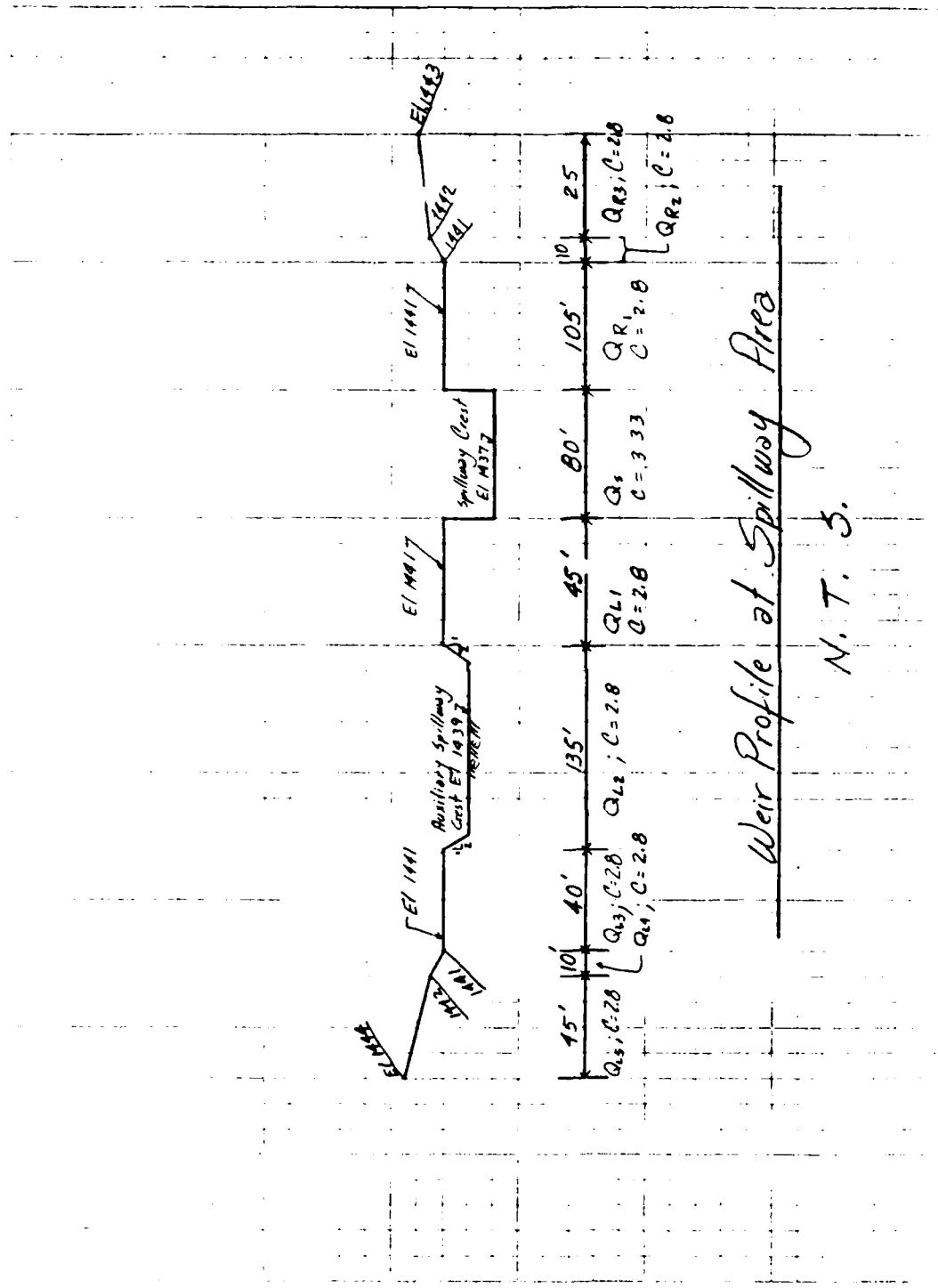
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CAMP DRESSER & MCKEE INC. CLIENT COE  
 PROJECT DAM INSP. DATE CHECKED 7/20/79 PAGE 3  
 DETAIL Cleveland Brook Reservoir CHECKED BY JED DATE 7-18-79  
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### TEST FLOOD DETERMINATION

The dam is classified as intermediate size and being of high hazard,

Test Flood is PMF

The terrain in the drainage area is rolling with a small area which is flat. Base the PMF determination on a point on the curve labelled "Rolling" terrain. The curve is taken from the N. E. D. Corps of Engineers "Preliminary Guidance for Estimating UPMF in Phase I of Dam Safety Investigations", March, 1978.

$$PMF = 2200 \text{ cfs} / \text{mi. sq.} \times 1.52 \text{ mi. sq} = 3,344 \text{ cfs}$$

say 3,350 cfs

### STAGE-DISCHARGE RELATIONSHIPS

Assume conditions as they were during field investigation

i.e. Flash boards in-place; spillway crest el 143.70

Compute Stage - Discharge Relationship (see weir profile next page)

Flow over the spillway is

$$Q (\text{cfs}) = 3.33 (B - 0.1 n H) H^{3/2}$$

Flow Over the Embankments, Main Dam and Dike A is

$$Q (\text{cfs}) = 2.8 B H^{3/2}$$

where B = length of weir, ft

H = Upstream Head measured above the crest. Use avg. Head where the weir is sloped

n = number of contraction

CAMP DREIBER & MCGEE INC.    CLIENT COE    JOB NO 380-6-RT-10    PAGE 2  
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### ELEVATIONS

Spillway crest w/ and w/o flashboards	1437.0 ; 1435.0
Toe of Main Dam	1371.0
Crest of Main Dam & Dike A	1442.0
Right Spillway Embankment (Dike C)	1441.0
Left Spillway Embankment (Dike B)	1439.0

Elevations based on 1963 Construction Alteration Dwg.  
 Datum is the 1927 National Vertical Geodetic Datum.

### SURFACE AREAS

@ el 1429.0 ; 194.6 acres  $\cong$  0.226 mi. sq. (Pond Surface Area)  
 1440.0 ; 156.6 acres  $\cong$  0.245 mi. sq  
 1450.0 ; 183.2 acres  $\cong$  0.286 mi. sq  
 Drainage area = 972.8 acres = 1.52 mi. sq.

### STORAGE VOLUMES

From 1963 McCalffy Eddy report (latest alterations), reservoir storage with two feet of flashboards in-place (El. 1437.0) is 5,230 acre-feet. At elevation 1435.0, storage is 4,928 ac-ft.

$$@ el 1440.0 = 5,230 \text{ ac-ft} + (150.6 \text{ ac}) 3 \text{ ft} = 5,682 \text{ ac-ft}$$

$$@ el 1445.0 = 5,682 + \left( \frac{183.2 + 156.6}{2} \right) 5 = 6,532 \text{ ac-ft}$$

### SIZE CLASSIFICATION

Hydraulic Height = 70-feet intermediate  
 The hydraulic height is based on a W.S.EI. of 1441 at dam failure.

Storage at Top of Dam (El 1442) = 6,022 ac-ft intermediate

### HAZARD CLASSIFICATION

The dam failure analysis (pages 9 - 28) indicates severe damage to property and a high potential for loss of life.

Hazard is HIGH

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RESERVOIR

JOB NO 380-6-RT-1D PAGE /  
 DATE CHECKED 5-7-79 DATE 4/14/79  
 CHECKED BY Jac A. COMPUTED BY CPM

Scale of Mapping. 1' = 2000'  $2000 \text{ ft} \times 91.83 = 183660 \text{ ft}^2$  Acres (A).

$$* A = 640 \cdot * \text{mi}^2$$

### DRAINAGE AREA

1. 8.01  $> 8.01 \text{ acre} = 8.01 \text{ m}^2 = 736 \text{ A} = 1.150 \text{ mi}^2$  ✓

2. 8.00 plus 0.37 sq mile area east of Schnepps Road diverted to the reservoir by a culvert as stated in original design computations of 1948 by MJE

### WATER SURFACES

#### EL. 1429

1. 1.56  $> 1.575 \text{ acre} = 1.575 \text{ m}^2 = 144.6 \text{ A} = 0.226 \text{ mi}^2$  ✓

2. 1.59

#### EL 1440

1. 1.70  $> 1.705 \text{ acre} = 1.705 \text{ m}^2 = 156.6 \text{ A} = 0.245 \text{ mi}^2$  ✓

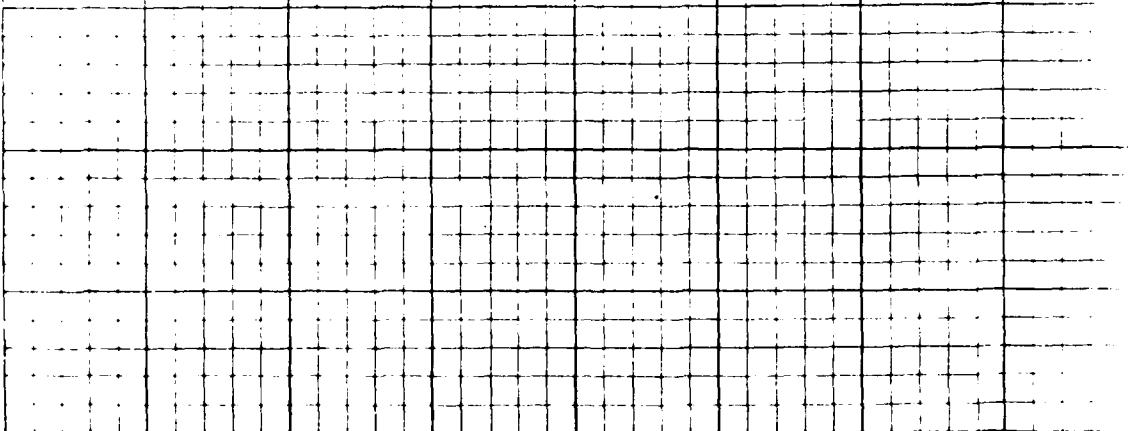
2. 1.71

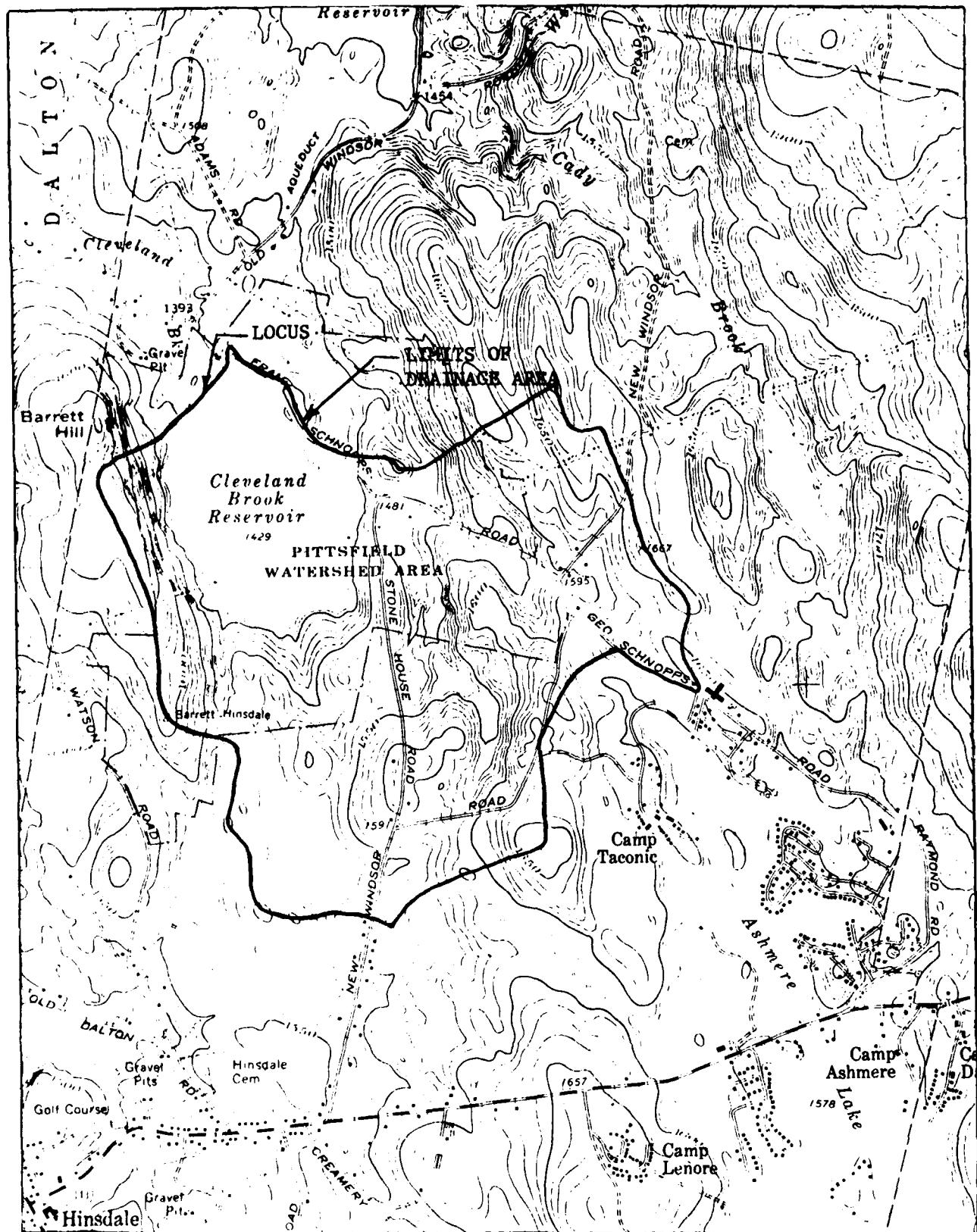
#### EL 1450

1. 1.99  $> 1.995 \text{ in}^2 = 183.2 \text{ Acres} = 0.286 \text{ mi. sq}$

2. 2.00

Elevations Based on National Vertical Geodetic Datum





DAM CLEVELAND BROOK RESERVOIR

IDENTIFICATION NO. MA 00225

DRAINAGE AREA MAP  
USGS QUADRANGLE

PERU, MASS

APPROX. SCALE: 1" - 2000'



APPENDIX D-1

## APPENDIX D

### MAPS AND HYDRAULIC/HYDROLOGIC COMPUTATIONS

Page No.

#### DRAINAGE AREA MAP

D-1

#### COMPUTATIONS

Drainage Area; Water Surface Areas	D-2
Elevations; Surface Areas; Storage Volumes;	
Size Classification; Hazard Classification	D-3
Test Flood Determination; Stage-Discharge Relationships	D-4
Surcharge Storage Routing	D-8
Tailwater Analysis	D-9
Dam Failure Analysis	D-10
Dam Failure Impact Area Map	D-30



18. VIEW TOWARDS SPILLWAY FROM DOWNSTREAM. LOW FLOW PIPE BENEATH ROAD OUTLETS IN FOREGROUND. DIKE C AT LEFT SIDE OF PICTURE AND DIKE B ON RIGHT SIDE OF PICTURE.



19. OVERVIEW OF DIKE C FROM EAST END. SPILLWAY AND DIKE B IN BACKGROUND.



16. SPILLWAY WEIR FROM DOWNSTREAM OF DIKE B.



17. SEEPAGE DOWNSTREAM OF SPILLWAY DISCHARGE APRON. DROP INLET FOR LOW FLOW PIPE BENEATH ROADWAY IN UPPER LEFT CORNER OF THE PICTURE.



14. OVERVIEW OF DIKE B AND OVERFLOW SPILLWAY FROM WEST END.



15. RIPRAP PROTECTION OF OVERFLOW SPILLWAY INVERT.



12. UPSTREAM FACE OF DIKE A FROM DAM RIGHT ABUTMENT.



13. CREST AND DOWNSTREAM FACE OF DIKE A FROM WEST END.



10. VALVE CHAMBER ON WATER TRANSMISSION MAIN DOWNSTREAM OF DAM.



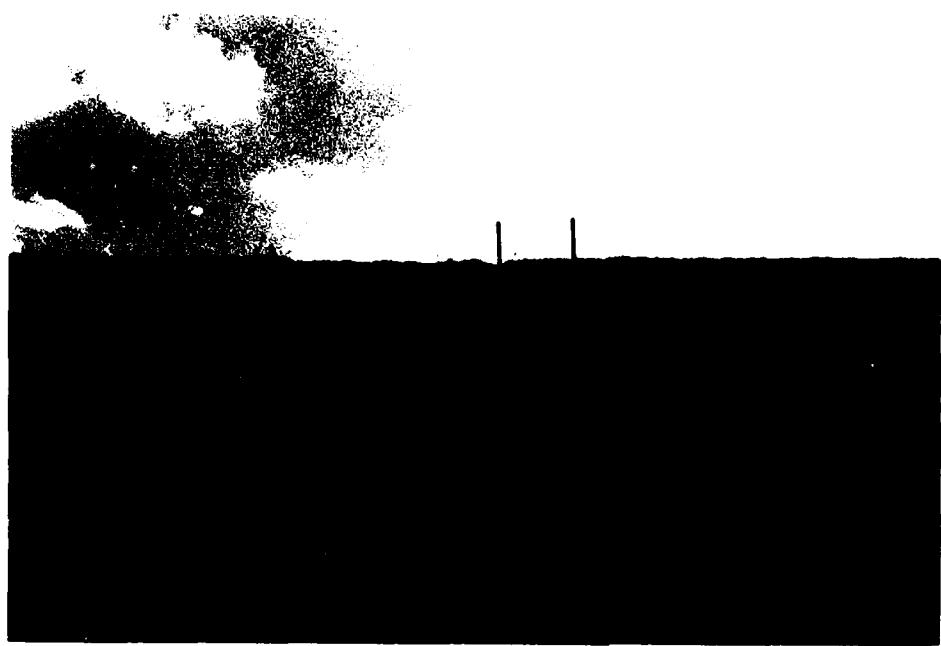
11. HEADWALL FOR BLOW-OFF FROM TRANSMISSION MAIN VALVE CHAMBER.



8. INTAKE GATEHOUSE (CONTROL TOWER) FOR WATER TRANSMISSION MAIN.



9. INTERIOR OF GATEHOUSE.



6. OBSERVATION WELLS ON DOWNSTREAM FACE OF DAM NEAR RIGHT ABUTMENT.

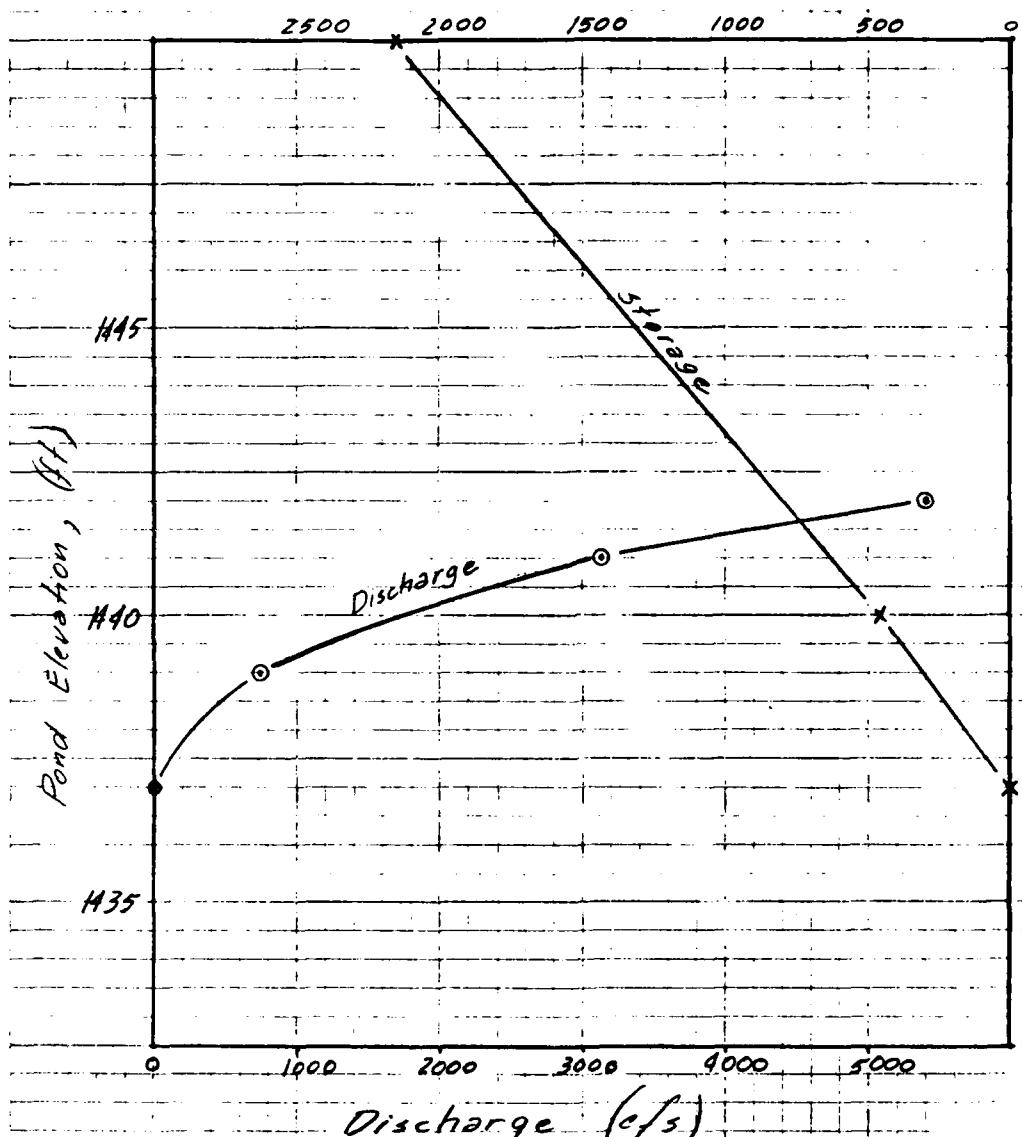


7. SEEPAGE AND FLOW MEASURING PIPE ON DOWNSTREAM FACE OF DAM NEAR RIGHT ABUTMENT.

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CLIENT COE JOB NO 380-6-RT-10 PAGE 6  
PROJECT Dam Imp. DATE CHECKED 7/30/79 DATE 7-18-79  
DETAIL Wendland BC Curve CHECKED BY JED COMPUTED BY Loc A.

*Storage Above Spillway Crest (Acre-ft)*



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DETAIL Cleveland Brk. Res.JOB NO 380-6-RT-10  
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DATE 7-18-79  
CHECKED BY JED  
COMPUTED BY Joe A.SURCHARGE STORAGE ROUTING

$$Q_p = 3,350 \text{ cfs} \quad (\text{see page 3, TEST FLOOD})$$

Surcharge Height to Pass  $Q_{p_1}$  is 1441.1 ft

$$\text{STOR}_1 = \frac{\text{Surcharge Storage}}{\text{Drainage Area}} = \frac{639 \text{ Ac-ft} \times 12 \text{ ft}}{973 \text{ Ac}} = 7.881''$$

Probable Max. Flood Runoff:

$$Q_{p_2} = Q_{p_1} \times \left(1 - \frac{\text{STOR}_1}{19}\right) = 3,350 \times \left(1 - \frac{7.881}{19}\right) = 1,960 \text{ cfs}$$

Surcharge Height to Pass  $Q_{p_2}$  is 1440.15

$$\text{STOR}_2 = \frac{478 \times 12}{973} = 5.895''$$

$$\text{STOR}_{\text{AVG}} = \frac{7.881 + 5.895}{2} = 6.888 \text{ inches}$$

$$Q_{p_3} = Q_{p_1} \times \left(1 - \frac{\text{STOR}_{\text{AVG}}}{19}\right) = 3,350 \times \left(1 - \frac{6.888}{19}\right) = 2,136 \text{ cfs}$$

Surcharge Height To Pass  $Q_{p_3}$  is 1440.28 ft.

$$\text{Related STOR} = \frac{500 \times 12}{973} = 6.170 \text{ in} < \text{STOR}_{\text{AVG}}$$

then compute  $Q_{p_4}$ :

$$\text{New STOR}_{\text{AVG}} = \frac{6.888 + 6.170}{2} = 6.529 \text{ inches}$$

$$Q_{p_4} = 3,350 \times \left(1 - \frac{6.529}{19}\right) = 2,199 \text{ cfs}, \text{ say } 2,200 \text{ cfs}$$

Surcharge Height To Pass  $Q_{p_4}$  is 1440.35 ft

Flow through spillway at test flood elevation (1440.35')

$$Q_s = 3.33(80)(3.35)^{1.5} = 1,633 \text{ cfs, say } 1,630 \text{ cfs}$$

Flow through Emergency spillway @ el 1440.35'

$$Q_{s_2} = 2.8(5.4)(0.675)^{1.5} + 2.8(127)(1.35)^{1.5} = 566 \text{ cfs}$$

CAMP DRESSER & MCKEE CLIENT COE JOB NO 390-6-RF10 PAGE 0  
 Environmental Engineers DATE CHECKED 7/18/79 DATE 7-18-79  
 Boston, Mass. PROJECT Dem. Insp. CHECKED BY JED COMPUTED BY Joe H  
 DETAIL Cleveland Pt. Res.

### TAILWATER ANALYSIS:

determine the capacity of the natural channel immediately downstream of the main spillway @ 95 WSEL = Spillway Crest El.:

$$Q = \frac{1.99}{n} A R^{0.9} S^{0.5} \quad \text{where } n \approx 0.095$$

$$A = 100 \times 7 = 700 \text{ sq ft}$$

$$R = \frac{A}{P} = \frac{700}{110} = 6.36$$

$$\therefore Q = \frac{1.99}{0.095} 700 (6.36)^{0.667} (0.015)^{1/2} S \approx 0.015$$

= 9,750 cfs >>> 1,633 cfs which discharges through the main spillway as a result of the Test Flood.

determine the capacity of the natural channel immediately downstream of the auxiliary spillway @ 95 WSEL = Spillway Crest El.:

$$\text{again } Q = \frac{1.99}{n} R^{0.9} S^{0.5} \quad \text{where } n \approx 0.05$$

$$A = 180 \times 1 = 180$$

$$R = \frac{A}{P} = \frac{180}{180} = 1$$

$$S \approx 0.015$$

$$\therefore Q = \frac{1.99}{0.05} 180 (1)^{0.6667} (0.015)^{1/2}$$

= 660 cfs > 566 cfs discharging at Test Flood

In addition to the capacity of the channel immediately downstream of the auxiliary spillway, discharge from the auxiliary spillway can freely flow to the channel immediately downstream of the main spillway thus eliminating the possibility of tailwater effects.

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DETAIL Charlton Bl. Res. CHECKED BY JED COMPUTED BY Joe A.

## DAM FAILURE ANALYSIS

determine. Q:

$$Q_p = \frac{8}{27} (\omega_b)(g)^{4\zeta} (Y_0)^{\frac{1}{2}}$$

where:  $W_0 = 10\%$  of the dam width measured at the mid-height of the dam  
 $= 1085 \times 0.4 = 434$  ft.

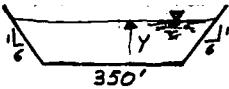
$$g = 32.2 \text{ ft/sec}^2$$

$$\begin{aligned}
 Y_0 &= \text{Hydraulic height at time of} \\
 &\text{dam failure. Assume pond level} \\
 &\text{at top of spillway dam.} \\
 &= 1471 - 1391 \\
 &= 70 \text{ ft}
 \end{aligned}$$

$$Q_p = \frac{8}{27} (434)(32.2)^{.5} (70)^{.5} \\ = 427,350 \text{ cfs}$$

REACH 1 : Dam to first crossing of Old Windsor Rd. and Cleveland Brook. Cleveland Brook crosses Old Windsor Rd. through a 6'Ø steel culvert. A V-notch weir is welded onto the d/s side of the 6'Ø steel culvert.

Assume a trapezoidal X-section and compute depth of flow.



$$Q = \frac{1.99}{2} A R^{3/2} S^{1/2}$$

where  $n$  = Manning's coeff assumed 0.045

A. J. DODD

$R = \frac{A}{P}$ , ft (hydraulic radius)

$$S = \text{P slope}, f_{eff} = 0.015$$

<i>y</i>	<i>Area</i> <i>ft</i> <sup>2</sup>	<i>Q</i> <i>cfs</i>
25	12,500	362,300
30	15,900	509,900

$y$  = depth of flow, ft

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 Environmental Engineers PROJECT Dam Large DATE CHECKED 7/10/79 DATE 6-19-79  
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Reach 1 (cont.)

depth of flow to carry 427,350 cfs is 27.2 ft.

compute storage in reach 1 and route flow:

$$V_1 = [12,500 + (5,900 - 12,500) 2.7] \times 128 \text{ ft} \times \frac{1 \text{ ac}}{43560 \text{ ft}^2}$$

$$= 395 \text{ ac-ft}$$

$$\text{then, } Q_{P_1}(\text{trial}) = Q_{P_1} \left(1 - \frac{V_1}{S}\right)$$

$$= 427,350 \left(1 - \frac{395}{2954}\right)$$

$$= 370,200 \text{ cfs}$$

$$Q_{P_1} = 427,350 \text{ cfs}$$

$$V_1 = 395 \text{ ac-ft}$$

$$S = \text{storage & time of dam failure} = 2954 \text{ ac-ft}$$

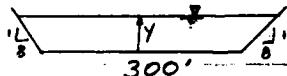
$$\text{based on a trapezoidal appr.}$$

based on  $Q_{P_1}$  trial  $V_2 = 350 \text{ ac-ft} : V_{\text{avg}} = 373 \text{ ac-ft.}$

$$Q_{P_2} = 427,350 \left(1 - \frac{373}{2954}\right) = 373,400 \text{ cfs} : Y = 25.4'$$

REACH 2: First to second crossing of Old Windsor Rd and Cleveland Brook. The brook culvert is a 6'Ø corrugated metal pipe, which is of little significance relative to the magnitude of the dam failure outflow.

Assume a trapezoidal X-section and determine depth of flow:



Slope for reach = 0.025  
 $n = 0.095$

$$Q = \frac{1.49}{0.045} \left[ (300 + 8Y)Y \right] \left( \frac{(300 + 8Y)Y}{300 + 2Y\sqrt{65}} \right)^{0.6667} (0.025)^{0.5}$$

$Y$ ft	Area $\text{ft}^2$	$Q$ cfs
15	6300	169,250
20	9200	290,100
25	12,500	445,750

$\downarrow$  average width for storage determination

$Y_1 = 22.7' ; V_1 = \frac{800 \times 22.5 \times 1300'}{13560} = 537 \text{ ac-ft.}$

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Reach 2 (cont.)

$$Q_{p_2}(\text{trial}) = 373,400 \left(1 - \frac{537}{2959}\right) = 305,450 \text{ cfs}$$

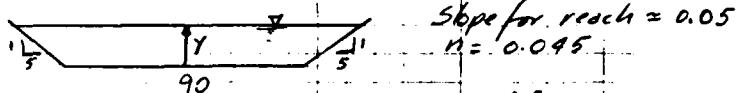
based on  $Q_{p_2}(\text{trial})$ ,  $V_2 = \frac{20.5 \text{ ft deep}}{22.5 \text{ ft deep}} 537 \text{ ac-ft} = 489 \text{ ac-ft}$

$$V_{\text{avg}} = 513 \text{ ac-ft.}$$

$$Q_{p_2} = 373,400 \left(1 - \frac{513}{2959}\right) = 308,550 \text{ cfs}$$

$$Y = 20.6'$$

REACH 3: Second to third crossing of Old Windsor Road and Cleveland Brook. The brook crosses under the road through bridge opening 11ft by 11ft. The bridge is of small hydrological significance when dealing with a flow of about 300,000 cfs. Determine depth of flow in the reach based on a trapezoidal X-section.



$$Q = \frac{1.49}{0.095} (90 + 5Y)Y \left( \frac{(90 + 5Y)Y}{90 + 2Y \sqrt{26}} \right)^{0.6667} (0.05)^{0.5}$$

$Y$ ft	$A$ $\text{ft}^2$	$Q$ $\text{cfs}$
25	5,375	298,250
30	7,200	368,650

$$@ Q = 308,550 \text{ cfs} \quad Y = 27.5 \text{ ft}$$

Given the steep slope, storage for the reach is negligible.

Assume  $Q_{\text{out}} = 305,000 \text{ cfs}$

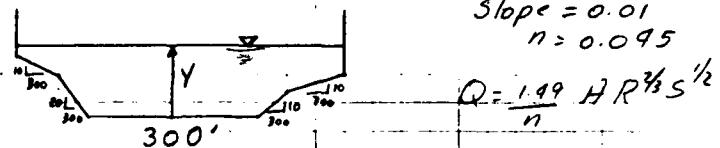
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REACH 9: Third crossing of Cleveland Brook and Old Windsor Road to confluence of Cleveland Brook and the East Branch of the Housatonic River. A section of this reach just downstream of the Old Windsor Rd can be assumed to have similar characteristics as reach 3. Assume depth of water in this reach to be about 27.5 ft. Beyond this section the topography changes radically. The slope flattens out and the overbank storage becomes very significant. Assume the following X-section to calculate depth of flow.



<u>Y</u> ft	<u>A</u> ft <sup>2</sup>	<u>P</u> ft	<u>Q</u> cfs
20	17,000	1,600	272,100
25	29,250	1,755	462,350

<u>Storage</u>	<u>Y, ft</u>	<u>El. Bpt. of Confluence</u>	<u>Area, acres</u>	<u>Storage, ac-ft</u>
	10	1150	8.3	$8.3 \times 5 = 42$
	20	1160	35	$42 + 21.7 \times 10 = 259$
	30	1170	78	$259 + 56.5 \times 10 = 824$

depth of water to pass 305,000 cfs is 20.9 ft.

$$V_1 = 310 \text{ ac-ft. } Q_{P_1}(\text{trial}) = 305,000 \left(1 - \frac{310}{2959}\right) = 273,000 \text{ cfs}$$

based on  $Q_{P_1}(\text{trial})$ ,  $V_2 = 260 \text{ ac-ft. } V_{avg} = 267 \text{ ac-ft.}$

$$Q_{P_2} = 305,000 \left(1 - \frac{267}{2959}\right) = 277,450 \text{ cfs}$$

$$Y = 20.2 \text{ ft}$$

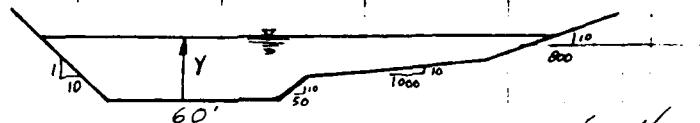
WSEI @ confluence of Cleveland Blk and the East Branch of the Housatonic River = 1160.2

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DETAIL Cleveland Brook Rec.

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REACH 5 Confluence of Cleveland Brook and the East Branch of the Housatonic River to street just upstream of Center Pond. The importance of the bridge relative to the flow is minor. Assume the road to blend into the surrounding topo, and base the depth of water on a trapezoidal X-section.



$$\text{slope} = 0.0036 \quad \left. \begin{array}{l} \\ \end{array} \right\} \text{assumed} \quad n = 0.095 \quad Q = \frac{1.99}{n} A R^{1/2} S^{1/2}$$

Y, ft	Area, ft <sup>2</sup>	Perimeter, ft	Q, cfs
25	17,625	1,960	163,700
30	26,550	2,210	276,700
20	8,950	1,310	64,000

### Storage

Y, ft	WSEI @ Bridge, ft	Area (acres)	Storage, ac-ft
10	1150	27	27 × 6.5 = 176
20	1160	98	176 + 37.5 × 10 = 551
30	1170	128	551 + 88 × 10 = 1431
90	1180	222	1431 + 175 × 10 = 3181

WSEI to pass 277,450 cfs is 1170

$$V_1 = 1431 \text{ ac-ft} \quad Q_{p1}(\text{trial}) = 277,450 \left(1 - \frac{1431}{2954}\right) Y=24.1'$$

based on  $Q_{p1}$  (trial)  $V_2 = 912 \text{ ac-ft} = 193,050 \text{ cfs}$

$$V_{avg} = 1172$$

$$Q_{p2} = 277,450 \left(1 - \frac{1172}{2954}\right) = 167,370 \text{ cfs}$$

$Q_{p2}$  corresponds to a depth of 25.2' = El 1165.2'

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Reach 5 (cont.)

Note that the WSEL at the bridge is 5-feet higher than at the confluence point, upstream. Reroute the flow through reach 4 assuming a WSEL at the confluence of Cleveland Brook and East Branch of Housatonic River of 1166.0.

Storage in reach 4 = 598 ac-ft

$$Q_{p_2} = 305,000 \left(1 - \frac{598}{2954}\right) = 243,250 \text{ cfs}$$

Reroute reach 5:

$$@ Q = 243,250 \quad \text{Stage} = 1168.5 \text{ ft or } Y = 28.5'$$

$$V_1 = 1299 \text{ ac-ft} \quad Q_{p_2(\text{trial})} = 243,250 \left(1 - \frac{1299}{2954}\right) = 136,300$$

based on  $Q_{p_2(\text{trial})}/Y = 23.8$   $V_2 = 885 \text{ ac-ft}$

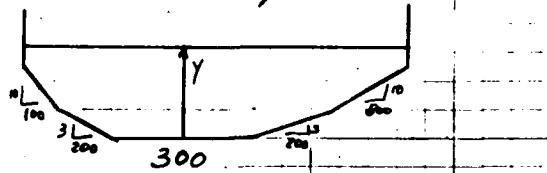
$$V_{\text{avg}} = 1092 \text{ ac-ft}$$

$$Q_{p_2} = 243,250 \left(1 - \frac{1092}{2954}\right)$$

$$= 153,300 \text{ cfs} \rightarrow Y = 24.5$$

$$\text{WSEL} = 1169.5'$$

REACH 6 Street upstream of Center Pond to section at mid-Center Pond.  
 Base WSEL on a trapezoidal X-section. Assume that flow is restricted to undeveloped overbank areas only.



$Y, \text{ft}$	$A_{\text{wet}}, \text{ft}^2$	$W_{\text{wet}}, \text{ft}$	$Q, \text{cfs}$
23	29,000	1625	207,900
21	25,800	1620	171,300

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Reach 6, (cont.)

Storage

	WSEI, ft	Area, acres	Storage, ac-ft	Y, ft
1140	17.5		$17.5 \times 3 = 53$	3
1150	71		$53 + 44 \times 10 = 493$	13
1160	128.6		$493 + 100 \times 10 = 1993$	23

Route flow through reach 6

$$Q = 153,300 \text{ cfs} ; Y = 20.0 ; \text{Storage} = 1193 \text{ Ac-ft.}$$

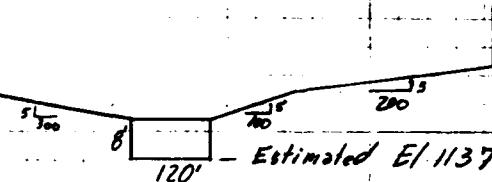
$$Q_{P_1(\text{trial})} = 153,300 \left(1 - \frac{1193}{2954}\right) = 91,400 \text{ cfs}$$

$$\text{based on } Q_{P_1(\text{trial})} \quad Y = 16.6 ; \text{Storage} = 853 ; S_{\text{avg}} = 1023 \text{ ac-ft}$$

$$Q_{P_2} = 153,300 \left(1 - \frac{1023}{2954}\right) = 100,200 \text{ cfs} ; \text{WSEI } 1159.1 \text{ ft.}$$

REACH 7: Mid of Center Pond to Main Street.

Assume section at Main Street to determine WSEI.



Rating Curve:

WSEI	Pressure Flow $C = 0.75$	Weir Flow $C = 2.8$	Total Flow, cfs
1150	12,900	8,100	21,000
1160	22,900	80,500	102,900

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Reach 7 (cont.)

Storage

WSEI	Area, acres	Storage, acre-ft
1140	34	$34 \times 3 = 102$
1150	56	$102 + 95 \times 10 = 552$
1160	105	$552 + 80.5 \times 10 = 1357$

Reach 7 routing

$Q = 100,200 \text{ cfs}$ ; WSEI = 1159.7; Storage = 1333 ac-ft.

$$Q_{P_2}(\text{trial}) = 100,200 \left(1 - \frac{1333}{2954}\right) = 55,000 \text{ cfs}$$

based on  $Q_{P_2}(\text{trial})$  WSEI = 1159.2; Storage = 890 for  $St_{\text{avg}} = 1112 \text{ ft}$

$$Q_{P_2} = 100,200 \left(1 - \frac{1112}{2954}\right) = 62,500 \text{ cfs}; \text{WSEI } 1155.1 \text{ ft}$$

Note that WSEI @ reach 7 is higher than @ reach 6.  
 Assume WSEI of 1155.5 ft @ reach 6 and reroute  
 through reach 7.

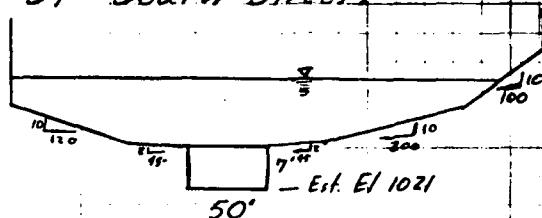
@ WSEI 1155.5 @ reach 6, the Storage = 1093 ac-ft.  
 This is approximately equal to the computed average storage  
 for reach 6. Therefore the computed  $Q_{P_2}$  for reach 6  
 is O.K. and the reach 7 routing is also good  
 as computed above.

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REACH 8: Main Street to South Street

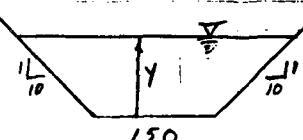
Estimate a cross-section @ South Street and determine the WSEL at South Street.



WSEL	Pressure Flow C = 0.7	Weir Flow C = 2.8	Total Flow, cfs
1040	6800	25,000	31,800
1045	8100	50,700	58,800
1050	9200	93,900	103,100

∴ WSEL to pass 62,500 cfs is 1045.4

Determine depth of flow at mid-reach. Assume a trapezoidal X-section



Avg Slope = 0.0075  
 $n = 0.095$   
 Length of reach = 7,000'

Y, ft	Area, ft <sup>2</sup>	Q, cfs
10	2,500	26,600
15	4,500	59,900
20	7,000	109,400

Average depth in the reach is 15.3 ft. The x-sectional area = 5,200 ft<sup>2</sup>.

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Reach 8 (cont.)

The slope in the reach is reasonably flat; some storage will accumulate in the reach.

$$@ \text{Area}_{\text{avg}} = 5,200 \text{ ft}^2, \text{Storage} = \frac{5200 \times 7000}{43560} = 836 \text{ ac-ft.}$$

$$Q_{p_1}(\text{trial}) = 62,500 \left(1 - \frac{836}{2954}\right) = 49,800 \text{ cfs.}$$

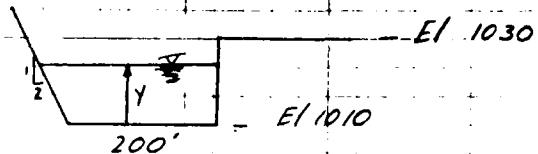
$$\text{based on } Q_{p_1}(\text{trial}), Y = 12.7' ; \text{storage} = \frac{3600 \times 7000}{43560} = 579 \text{ ac-ft.}$$

$$\text{Avg Storage} = 708 \text{ ac-ft.}$$

$$Q_{p_2} = 62,500 \left(1 - \frac{708}{2954}\right) = 47,500 \text{ cfs. WSEL C South St Est. @ 1042.9}$$

REACH 9 : South street to Dam just downstream of sewage Disposal Facilities.

Assumed Dam Profile:



WSEI	Dam Weir Flow (cfs); C=3.3	Overbank Weir Flow (cfs); C=2.8	Total Flow (cfs)
------	-------------------------------	------------------------------------	---------------------

1010			0
1020	20,850	650	21,500
1025	38,350	1750	40,100
1030	59,050	3550	62,600

Storage

WSEI	Area, acres	Storage, ac-ft.
1020	37	37 × 5 = 185
1030	93	185 + 40 × 10 = 585

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Reach 9 (cont.)

route flow through reach 9:

to pass 47,500 cfs, WSEI @ Dam is 1020.6; Est. Storage = 41.

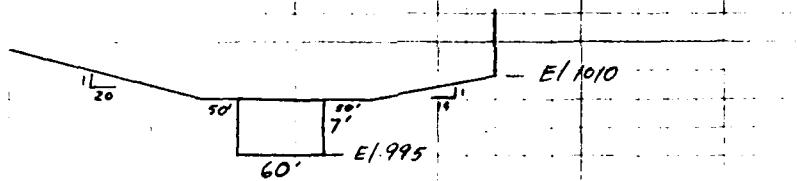
$$Q_{P_2}(\text{trial}) = 47,500 \left(1 - \frac{41}{2954}\right) = 40,300 \text{ cfs}$$

based on  $Q_{P_2}(\text{trial})$ , WSEI = 1025 and Storage = 385;  $Sto_{AVG} = 417 \text{ cfs}$

$$Q_{P_2} = 47,500 \left(1 - \frac{417}{2954}\right) = 40,800 \text{ cfs}; WSEI 1025$$

REACH 10: Dam to Hubbard Avenue. Length of reach is small, and storage for the reach is negligible. The reason for taking a section at Hubbard Avenue is to determine if the 4/5 dam is flooded and by how much.

Estimated X-Section at Hubbard Avenue:



WSEI	Pressure Flow $c = 0.7$	Weir Flow $c = 2.8$	Total Flow (cfs)
1010	6700	16,200	22,900
1015	8,500	39,700	48,200

backwater elev = 1013.5'; WSEI @ Dam = 1025.

if  $\frac{Q}{Q_i} = \left(1 - \left(\frac{H_2}{H_1}\right)^{1.5}\right)^{0.385}$  where:  $Q$  = free discharge  
 $Q_i$  = reduced discharge  
 $H_2$  = backwater height  
 $H_1$  = Water height @ Dam

$$\frac{Q}{Q_i} = \left(1 - \left(\frac{3.5}{15.2}\right)^{1.5}\right)^{0.385} = 0.96$$

= percent of free discharge due to flooding of dam by backwater

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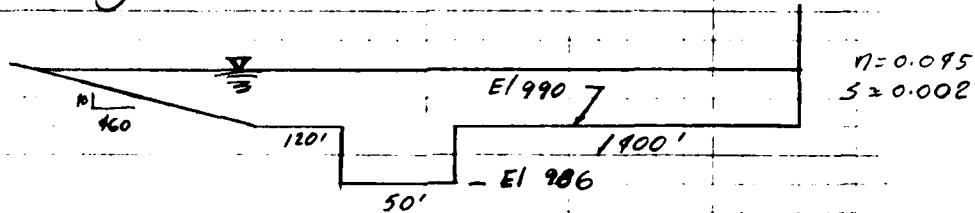
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reach 10 (cont.)

It appears that flooding of the dam reduces its efficiency by about 4 percent which can be neglected.

REACH 11: Hubbard Avenue to road embankment upstream of railroad bridge.

Compute WSEI based on a section through the roadway embankment.



Because most of the flow will be overbank flow, where the roadway blends with the surrounding topography, compute rating curve for the section based on open channel flow, rather than flow over a weir.

NSEI (ft)	X-Section Area (ft <sup>2</sup> )	Wetted Perimeter (ft)	Flow (cfs)
995	8625	1813	36,100
997	12,317	1907	63,250

WSEI at road embankment is approx 995.4'

There is considerable storage in reach 11. A lot of this storage is along a tributary brook called Unknown Brook.

Storage

	WSEI	Area, acres	Storage, ac-ft
	990	96.5	96.5X1.5 = 70
	1000	393.5	70 + 220X10 = 2270

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Reach 11 (cont.)

route flow through reach 11:

@ WSEI 995.4, storage = 1258 ac-ft

$$Q_{P_2}(\text{trial}) = 40,800 \left(1 - \frac{1258}{2959}\right) = 23,400 \text{ cfs.}$$

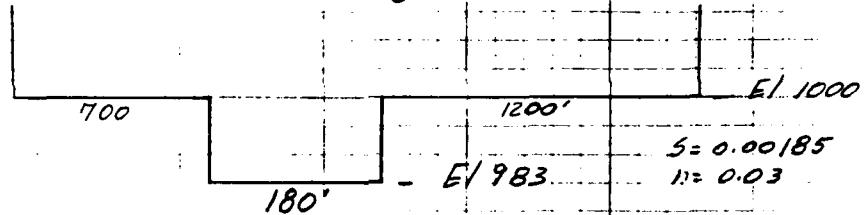
based on  $Q_{P_2}(\text{trial})$ , WSEI = 999.1'; Storage = 972 ac-ft

Storage ~~WSEI~~ = 1115 ac-ft.

$$Q_{P_2} = 40,800 \left(1 - \frac{1115}{2959}\right) = 25,400 \text{ cfs}; \text{WSEI} = 994.2'$$

REACH 12: Road embankment to railroad bridge.

Estimated X-Section through R.R. embankment.



WSEI. (ft)	Area (ft <sup>2</sup> )	Wetted Perimeter (ft)	Flow (cfs)
990	1260	194	9,350
1000	3060	214	38,500

Storage	WSEI	Area, acres	Storage, ac-ft
	990	80	$80 \times 1.5 = 120$
	1000	208	$120 + 14.9 \times 10 = 1560$

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 DETAIL Cleveland Bl. Rec.

reach 12 (cont.)

route flow through reach 12:

$\therefore Q = 25,900 \text{ cfs}$ , WSEI = 995.5 ft., storage = 912 ac-ft.

$$Q_{p_2}(\text{trial}) = 25,900 \left(1 - \frac{912}{2954}\right) = 17,550 \text{ cfs}$$

based on  $Q_{p_2}(\text{trial})$ , WSEI = 992.8 ft; sto = 523 for  $Sto_{H_6} = 718$

$$Q_{p_2} = 25,900 \left(1 - \frac{718}{2954}\right) = 19,250 \text{ cfs}; \text{WSEI}_{\text{bridge}} = 993.4'$$

Determine WSEI just upstream of the bridge:

contraction loss:

$$h_c = 0.5 \left( \frac{V_1^2 - V_2^2}{2g} \right) \text{ for sharp cornered entrance}$$

$$\text{Velocity upstream, } V_2 \approx \frac{Q}{700 \times 10.5} = \frac{Q}{7350} \text{ ft/s} = 2.6 \text{ ft/s}$$

$$\text{Vel downstream, } V_1 = 19,250 / 1875 \approx 10.3 \text{ ft/s}$$

$$h_c = 0.5 \left( \frac{10.3^2 - 2.6^2}{64.4} \right) \approx 0.8 \text{ ft}$$

$\therefore$  WSEI just upstream of the bridge  $\approx 994.2$  ft.

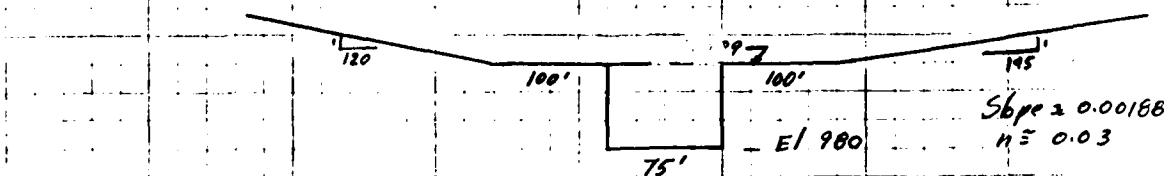
and storage for the reach  $\approx 725$  ac-ft

$$\therefore \text{corrected outflow} = 25,900 \left(1 - \frac{725+718}{2954}\right) = 19,200 \text{ cfs}$$

REACH 13: Railroad Bridge - to bridge at East Street

Assume a control section at the East Street bridge.

Estimated X-Section:



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reach 13 (cont.)

WSEI	Orifice Flow, cfs	Weir Flow, cfs	Total Flow
989	5,450	—	5,450
993	10,900	10,100	20,500

Storage:

WSEI	Area, acres	Storage, ac-ft
990	14	14 x 1.5 = 21
1000	32	21 + 23 x 10 = 251

Route flow through reach 13:

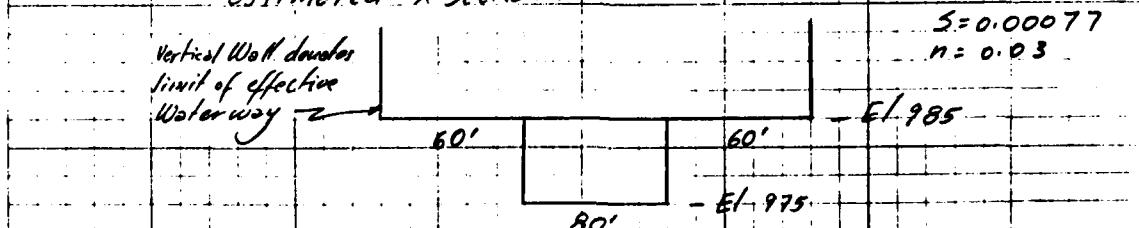
@ Q = 19,200 cfs, WSEI = 992.7 and Storage = 83 ac-ft  
 since storage is small, no iterations are required.

$$Q_{P_2} = 19,200 \left(1 - \frac{83}{1954}\right) = 18,650 \text{ cfs}; \text{ WSEI } 992.5$$

### REACH 14: East Street to Newell Street

Assume the Newell St. Bridge to be the control section:

Estimated X-Section:



WSEI	Orifice Flow, cfs	Weir Flow, cfs	Total Flow, cfs
985	4,900	—	4,900
900	11,900	6,250	18,150

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reach 14 (cont.)

Storage:

WSEI	Area, acres	Storage, ac-ft
980	31	31x2.5 = 78
990	660	78 + 345.5x10 = 3533

Reach 14 provides considerable storage. Instead of taking a section at mid-reach to maintain the storage for the reach below 50% of the reservoir storage, use the following approach.

Assume a flow @ Newell Street of 7000 cfs.

WSEI @ Newell St. = 986.0 ft; assume a WSEI of 986.5 @ mid-reach.  
 Average Storage for the total reach.  $\approx 2324 \text{ ac-ft}$   
 At mid-reach, the storage = 1162 ac-ft

$$Q_p @ \text{mid reach} = 10,650 \left(1 - \frac{1162}{2954}\right) = 11,300 \text{ cfs}$$

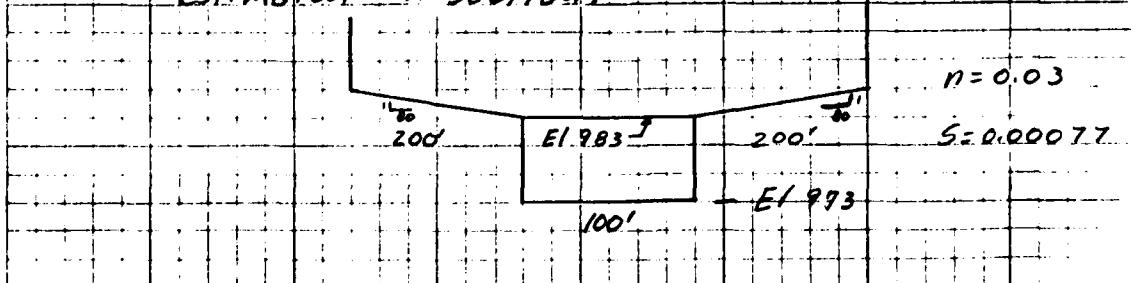
$$Q_p @ \text{Newell St} = 11,330 \left(1 - \frac{1162}{2954}\right) = 6,850 \text{ cfs}$$

resulting WSEI @ the bridge  $\approx 985.9 \text{ ft} \approx 986.0' \text{ ok.}$

REACH 15: Newell Street to bridge at unnamed downstream street between East & Newell Street.

Assume that the bridge at the unnamed street controls.

Estimated X-section.



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<u>WSEI</u>	<u>Orifice Flow, cfs</u>	<u>Weir Flow, cfs</u>	<u>Total Flow, cfs</u>
	$C=0.7$	$C=2.8$	
983	5,650	-	5,650
988	12,550	11,250	23,800

<u>Storage</u>	<u>WSEI</u>	<u>Area, acres</u>	<u>Storage, acre-ft</u>
	980	16	$16 \times 6 = 96$
	985	42	$96 + 29 \times 10 = 386$

@  $Q = 6,850 \text{ cfs}$ ,  $WSEI = 983.3'$  and  $\text{Storage} = 192 \text{ ac-ft}$ .

$$Q_{P_1}(\text{trial}) = 6,850 \left(1 - \frac{192}{2959}\right) = 6,900 \text{ cfs.}$$

based on  $Q_{P_1}(\text{trial})$ , storage  $\approx 189$  for an avg. of 191 ac-ft.

$$Q_{P_2} = 6,850 \left(1 - \frac{191}{2959}\right) = 6,400 \text{ cfs.}, WSEI 982.2'$$

REACH 16: Unnamed street to Elm Street.

Assume X-section of Elm street bridge to be the control section

Estimated X-section:

EI 983.5

$n = 0.03$   
 $s = 0.00077$

100

- EI 971.5

<u>WSEI</u>	<u>Flow, cfs</u>	<u>(based on Manning's Open Channel Eq.)</u>
981.5	5650	
983.5	7500	

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PROJECT Dover Twp.  
DETAIL Cleveland Blvd Res.

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reach 16 (cont.)

Storage:

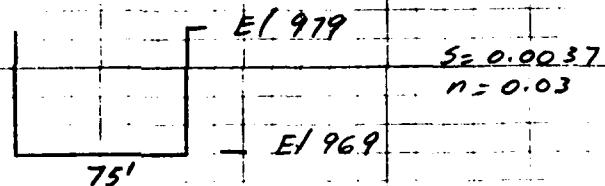
WSEI	Arc, acres	Storage, ac.ft.
180	18	18x8 = 144
185	39	144 + 28.5x10 = 419

@ Q = 6,900 cfs, WSEI ≈ 982.3'; Storage = 210 ac.ft.  
since storage is minor, no iterations are necessary.

$$Q_p = 6,900 \left(1 - \frac{210}{2954}\right) = 5,950 \text{ cfs.}; \text{WSEI } 981.8'$$

REACH 17: Elm Street to Dawes Avenue

Estimated X-Section at Dawes Avenue:



There is no material storage in reach 17.

WSEI	Flow
977	6350
979	9000

@ Q = 5,950 cfs. WSEI ≈ 976.7 ft. @ Barns Rd.

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REACH 18: Daves Ave. to Pomeroy Avenue crossing with the East Branch of the Housitonic River.

Assume a cross section at Pomeroy Avenue similar to that at Daves Avenue.

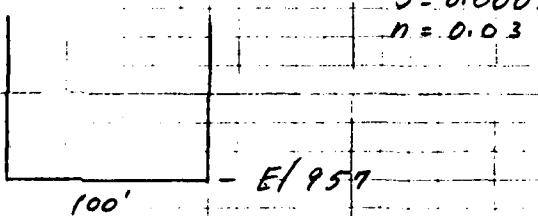
Therefore, if bottom channel elevation = 963 ft, the WSEL at Pomeroy Ave = 970.7

at this WSEL, Storage is approx  $400\text{ft} \times 1400\text{ft} \times 4\text{ft} = 52\text{ac. ft}$   
43560

$$Q_p = 5950 \left(1 - \frac{52}{2954}\right) = 5,850 \text{ cfs.}; \text{WSEL } 970.4'$$

REACH 19: Pomeroy Ave @ East Br. of Housitonic to Pomeroy Ave. to Housitonic River.

Estimated X-Section:



$$S = 0.00059$$

$$n = 0.03$$

WSEL	Flow, cfs
967	4950
970	7450

Storage:

WSEL	Area, acres	Storage, ac-ft
960	28	$28 \times 1.5 = 42$
970		$42 + 90 \times 10 = 942$

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 Environmental Engineers PROJECT Dam Inspection  
 Boston, Mass. DETAIL Cleveland Pk. Res.

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reach 19 (cont.)

@  $Q = 5,850 \text{ cfs}$ , WSEL = 968.1 ; Storage = 771 ac-ft.

$$Q_p(\text{trial}) = 5850 \left(1 - \frac{771}{2959}\right) = 9,323 \text{ cfs}$$

based on  $Q_p$  trial, WSEL = 966.2 ; Sto = 600 ac-ft

$$St_{\text{avg}} = 686 \text{ ac-ft}$$

$$Q_p = 5850 \left(1 - \frac{686}{2959}\right) = 9,500 \text{ cfs.}$$

WSEL = 966.5 ft.

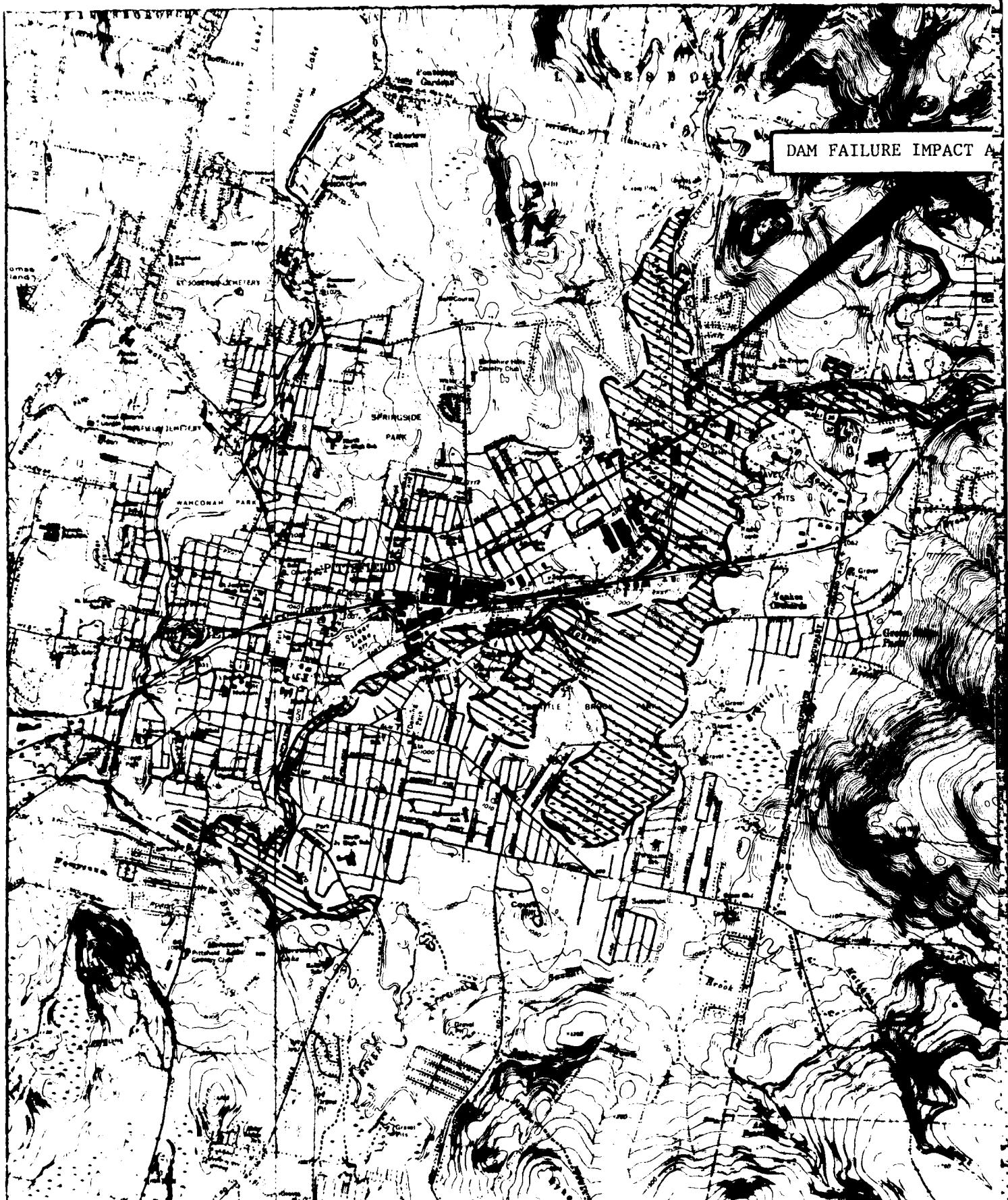
REACH 20: Pomeroy Ave. at Housatonic River to Holmes Road.

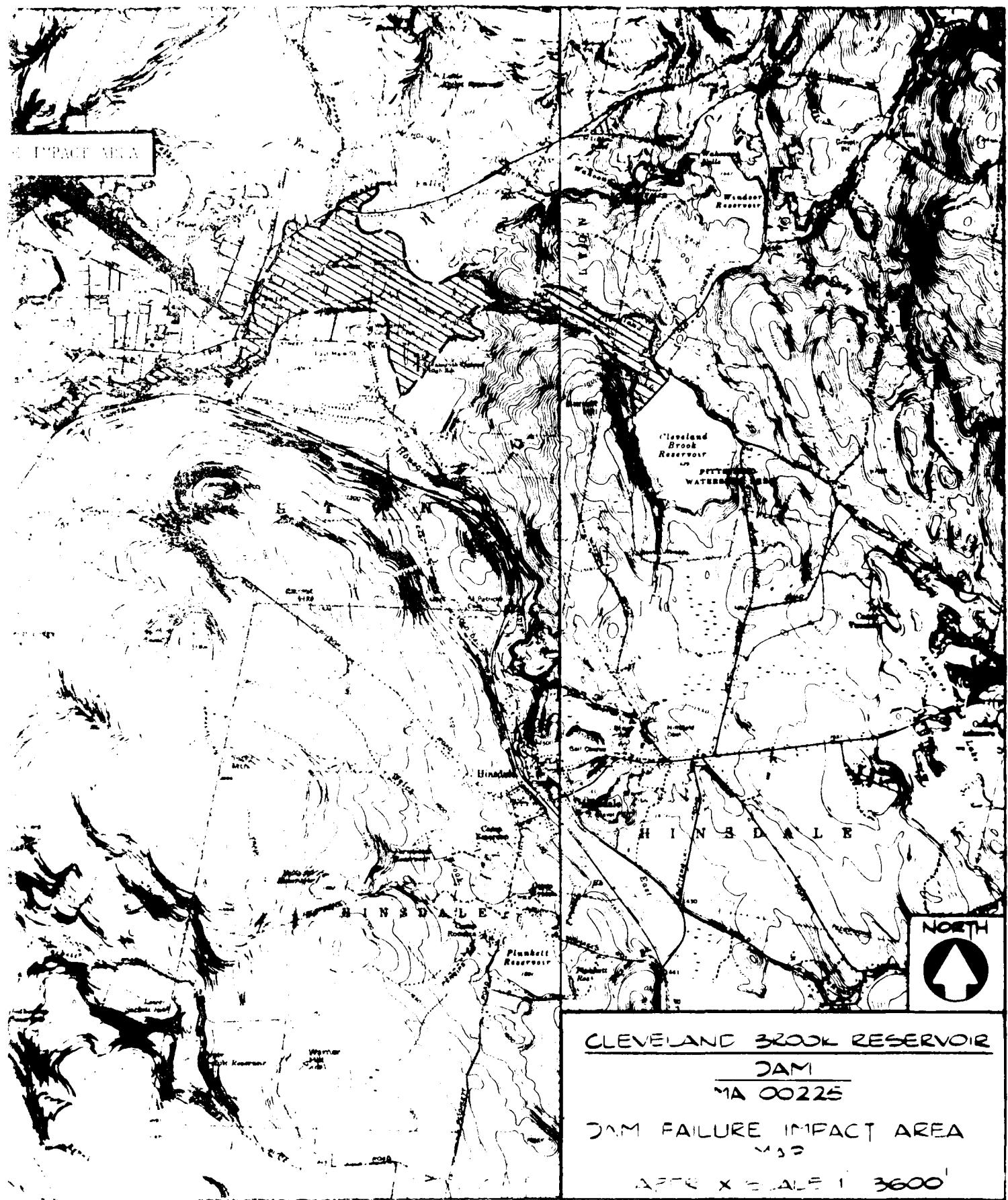
Assume the bridge at Holmes Road to have a capacity similar to that at Pomeroy Ave. The channel invert at Holmes Road is about the same elevation as at Pomeroy Ave. Therefore the

WSEL @ Holmes Road = 966.5

Beyond Holmes Road the overbank storage is extensive the remaining flow will be attenuated and no further potential for loss of life or property is expected.

From the Cleveland Reservoir up to Holmes Road the potential for loss of life and property is HIGH





2

APPENDIX D-30

APPENDIX E  
INFORMATION AS CONTAINED IN  
THE NATIONAL INVENTORY OF DAMS

# INVENTORY OF DAMS IN THE UNITED STATES

STATE NUMBER	IDENTITY DIVISION	STATE	COUNTY UNIT	COUNTY	CONC. DIST.	NAME	LATITUDE (NORTH)	LONGITUDE (WEST)	REPORT DATE
MA 225	NED	MA 003	01			CLEVELAND BROOK RESERVOIR DAM	42°28' .2	73°06'.9	31 MAY 79

POPULAR NAME	NAME OF IMPOUNDMENT
	CLEVELAND BROOK RESERVOIR

REGION/BASIN	RIVER OR STREAM	NEAREST DOWNSTREAM CITY-TOWN-VILLAGE	DIST FROM DAM (MI.)	POPULATION
01 07	CLEVELAND BROOK	DALTON	0	7500

TYPE OF DAM	YEAR COMPLETED	PURPOSES	HYDRAULIC HEAD (FT.)	IMPOUNDING CAPACITIES (ACRES)	NORMAL (ACRES)	MAXIMUM (ACRES)	IMPERVIOUS SURFACE (ACRES)	DIST OWN FLO R PHV/FED SCS A VER/DATE
HEPG	1948	S	71	70	6022	4928	4928	NEU N N N N N

REMARKS

DS HAS LENGTH	SPILLWAY TYPE	MAXIMUM DISCHARGE (FT.)	VOLUME OF DAM (CY)	POWER CAPACITY INSTALLED (MW)	PROPOSED NO LENGTH	NOT LENGTH	NAVIGATION LOCKS
1	1650 U	80	4650				

REMARKS

OWNER	ENGINEERING BY	CONSTRUCTION BY
CITY OF PITTSFIELD	METCALF + EDDY ENGINEERS	

DESIGN	CONSTRUCTION	OPERATION	Maintenance
None	None	None	None
CAMP DRESSER + MCKEE INC		01 MAY 79	PUBLIC LAW 92-367

REMARKS

**END**

**FILMED**

**7-85**

**DTIC**